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THE UNIVERSITY OF ALBERTA

A Study of Technology and Innovation in the Food Processing Industry in Alberta

by

Rodney E. Dlugos

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF SCIENCE

IN

AGRICULTURAL ECONOMICS

Department of Rural Economy

Edmonton, Alberta

Spring, 1985

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled A Study of Technology and Innovation in the Food Processing Industry in Alberta submitted by Rodney Dlugos in partial fulfilment of the requirements for the degree of MASTER OF SCIENCE in AGRICULTURAL ECONOMICS.

ABSTRACT

The main purpose of this study was to look at the technological progress being made in Alberta's Food Processing Industry.

A literature review of recent studies on technological innovation and policy was also undertaken. Reference was made to work carried out in Canada, the U.S., and the U.K. The work undertaken has attempted to provide a discussion of major government programs that are applicable to Canadian food processors who wish to develop new products or processes. A recent Task Force report on Federal Policies and Programs for Technology Development, which discusses and criticizes current programs, was reviewed in light of the programs discussed.

The primary research methodology utilized in this study involved questionning industry spokesmen with regard to their attitudes and concerns about technology and its importance to their livelihood.

Based on the results of this study, it is evident that Alberta's food processors do consider research and development to be important to their future. What is unclear, however, is the role that Alberta food processors wish government to play. Does the industry prefer government grants and loans to direct government-run research or does it prefer no government involvement at all? One must keep in mind that one-third of the respondents felt that further government involvement was not necessary. As well, the

question arises as to whether further support should be provided to "small" and "medium-sized" firms, with very small market shares, or to focus on the large, "more efficient" processing plants.

This research has been undertaken as a first step in studying Canada's food processing industry. Several conclusions have been made and some recommendations are listed below.

1. If it is the intention of the governments to make assistance available to all economically viable firms, regardless of size or years of operation, then application procedures for research and development incentive programs may have to be redesigned. Eligibility criteria and administrative lag time are two key areas which deserve immediate attention.
2. Expanded use of research pools should be encouraged, where feasible, as a possible alternative to government assistance.
3. Availability of program information has been identified as a problem. The use of "Science Extension Officers" or other forms of communication which improve the awareness of processors regarding assistance programs would be beneficial.
4. This study has just begun to describe the attitudes of industry towards government. Further work is needed to ascertain the exact role that private industry wishes government to have in R and D. Such information can only

be collected through direct interface between government and the food processing industry.

5. As an addendum to this study, it is recommended that workshops be organized in central locations in Alberta that would facilitate open communication between government representatives (Federal and Provincial) and the industry. The importance of personal contact with food processors should be stressed when arranging such meetings to ensure fair respresentation from all sectors and plant/firm-size groups.

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I will be forever indebted to the undying support of Dr. Murray Hawkins. His advice was always sound and his encouragement, always sincere. Greg Smith, my colleague and friend, spent a long summer working on the project with me. His devotion and abilities will not be forgotten.

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I. INTRODUCTION

If a man goes without food for one day, he will lie. If he goes without food for two days, he will steal. If he goes without food for four days, he will riot and kill. The food business is the most essential in the world, and the largest.

NATHAN STEINBERG, supermarket magnate, quoted by Peter C. Newman in *Flame of Power*, 1959.

Background

Canada's food processing industry is changing. Consumer tastes are shifting away from traditional consumption patterns, and as a result, any segment of the food industry that does not keep pace with consumer demands will suffer.

We have seen technological changes in food processing ranging from boxed beef to U.H.T. milk treatment. However, the impacts and significance of such developments are difficult to assess with information at hand. Similarly, at present, the needs of food processors are not known well enough to facilitate government policy designed to enhance further technological development.

This study attempts to examine Alberta's progressiveness in its food processing activities. As well, recommendations are made that may encourage food processors to more readily produce new products and adopt more efficient production processes.

Study Objectives

The study objectives are outlined below:

1. To document the location and organizational structure of the food processing industry in Alberta, with reference to Canada.
2. To classify food processing operations by age, size, and current level of technological commitment.
3. To undertake a study into the level and trends of technological development in the food processing industry in Alberta.
4. To ascertain if current and projected expenditures on technology are adequate.
5. To examine the restrictions and constraints in meeting any technological gap which might exist in developing a competitive food processing industry.
6. To develop an understanding of the future technological innovations which will affect food processing in the immediate and distant future.

Scope and Methodology

This study examines Alberta's food processing industry which consists of over 250 firms. The product categories examined include all food and beverage items produced for human consumption with the exception of alcoholic beverages.

Much of the data and information included in Chapters I through IV were gathered from secondary sources, including studies and various other publications, which are cited. The

information and data found in Chapter V and beyond were extracted from a series of three questionnaires completed by Alberta food processors.

The procedure used to conduct this study can be divided into four phases.

Phase I. Organization Theory literature was used to give an overview of how the food processing industries in Canada and Alberta have evolved. Secondly, a discussion of relevant studies looking at innovation and technological change in the food processing industry was undertaken. Finally, a literature review of government programs and policies has shed some light on the level of encouragement now being provided to food processors wishing to develop new products or processes. A Task Force report was also utilized to provide some insight into the effectiveness of current government programs.

Phase II. The primary data used in Phase II were collected through the use of a questionnaire sent to Alberta food processors. The questionnaire was designed to indicate some basic structural features of the various sectors. As well, the survey probed into the level of current Research and Development spending and involvement with government programs.

Phase III. Phase III consisted of two additional questionnaires which were aimed at obtaining the opinions of industry experts on research and development and technological and economic trends which will affect future

company direction. Rather than putting all of these experts together for a discussion, a variation of the Delphi technique was utilized in order to solicit their opinions on an organized basis through individual mail-out questionnaires. The first round of opinions obtained in Phase III was distilled and resubmitted to the experts for a second round of ranking and feedback.

Phase IV. The final phase consisted of compiling and analyzing all of the results obtained to form conclusions and recommendations that could be used to provide some thoughts as to possible stimuli for technological development in Alberta's food processing industry.

Organization of the Thesis

Chapter II utilizes information available to provide an overview of the industrial organization of the food processing industry in Canada and Alberta.

Chapter III serves as a review of relevant and recent studies conducted on technological change and policy in the food processing industry. The chapter relies to a large extent on American and European literature.

Chapter IV summarizes the majority of government programs available to food processors that are designed to stimulate technological advancement in the food processing industry. The chapter also reviews a recent Task Force report on Federal Programs.

Chapter V discusses the results of the Phase II questionnaires from qualitative and quantitative standpoints.

Chapter VI is based on the results of the Phase III questionnaires.

Chapter VII provides a summary and conclusions with recommendations that were formulated from this study.

II. THE FOOD PROCESSING INDUSTRY IN CANADA: A Review of its Industrial Organization

Introduction

The market structure of the food processing industry in Canada appears to be in a state of transition. Over the last twenty-five years, the number of processing facilities in several sectors has steadily declined as the demand for some goods has fallen. Conversely, the number of processing plants and the level of consumer demand in other sectors has escalated.

Imports and foreign-owned firms, justly or unjustly, have become the scapegoats to many domestic processors looking for the cause of their deteriorating market share. Available indicators point to a major restructuring of the industry, although inadequate data in many areas thus far make a detailed analysis of market structure somewhat open to speculation.

According to Organization Theory, (the Structure-Conduct-Performance approach), the market structure of an industry plays an important role in determining market conduct and performance. Market structure, in this context, is comprised of several elements, including three major features: seller concentration, product differentiation, and barriers to entry of new firms, as well as a variety of other factors

that have varying effects depending on the industry being examined.

Market structure has been used as a basis for predicting the level of technological change in an industry.[1] Galbraith and Schumpeter argue several points: 1) only large firms can afford to undertake R and D, 2) economies of scale in research may exist in large firms and, 3) only large firms can capture the full benefits of the newly developed product or process.[2] The opponents to this view argue that large firms with market power have no competition and therefore, no stimulus to undertake costly R and D or to adopt new processes and products.[3] This debate has yet to be conclusively resolved.

Market conduct simply refers to the policies that market participants have with regard to their market and their rivals. These policies can refer to prices, degree of product differentiation, barriers to entry or any other market element.

Market performance is used to judge how much an industry contributes to fulfilling the goals of the economy. One such goal is usually " ... to be efficient, employing its scarce factors of production so that they yield the highest possible real income...".[4] "Market Performance is

---

[1] The views of Galbraith, Schumpeter, Mason, Mansfield, and Scherer on this topic are discussed in Chapter 9 of James V. Koch, *Industrial Organization and Prices*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1980.

[2] Koch, p. 226.

[3] *Ibid.*

[4] Richard Caves, *American Industry: Structure, Conduct, Performance*, Prentice-Hall, Inc., Englewood Cliffs, New

our normative appraisal of the social quality of the allocation of resources that results from a market's conduct."[5]

The purpose of this chapter is two-fold. First, it will examine the structural features of the Canadian food processing industry, making use of the information available. This discussion will provide a basis for some possible new conclusions to be drawn on the "market structure and technological change" debate when the results of the primary research of this study are discussed in later chapters. Second, a discussion outlines the areas of industrial organization and technology adoption where the current data are conflicting or insufficient to form any reasonable conclusions.

Structure of the Food Processing Sector

Structure, as an organization theory concept, "...means those characteristics of the organization of a market which seem to influence strategically the nature of competition and pricing within the market."[6] The characteristics combine to yield a particular market structure for an industry, in this case the food processing industry. The following sections describe the elements individually.

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[4](cont'd) Jersey, 1980, p. 17.
[5]*Ibid.*, p. 14.
[6]Joe S. Bain, *Industrial Organization*, John Wiley & Sons, Inc., New York, 1959, p.7.

Concentration

Concentration can be defined as the "... number and size distribution of sellers and buyers in the market place."[7] Buyer concentration is seldom mentioned in the food processing sector. It is assumed (rightly or wrongly) that consumers are homogeneous entities, each with equal information and bargaining power, thus making their side of the market purely competitive. With such little effort focused in this area, it must also be assumed that there are many producers supplying the processors. This leaves the bulk of the analysis to center on the processors themselves, the seller concentration.

Uhm and de Graaf[8] conducted structural analysis of the processed fruit and vegetable industry in Canada (Statistics Canada's Standard Industrial Classification (SIC) 1031). They found that the top four firms "... accounted for 39% of the national market (by shipment value) in 1980."[9] Regional concentration levels were shown to be some 30% higher than national levels[10] using 1965 data.

Warnock compared the differences between four and eight-firm concentration levels at a regional and national level for the major food and beverage sectors (Table 2-1).

---

[7]Koch, p. 172.
[8] Ihn H. Uhm and Jim de Graaf, "The Canned and Preserved Fruit and Vegetable Industry in Canada: Transportation Factors and the Industrial Situation."*Food Market Commentary. (June, 1983)*
[9]*Ibid.*, p.29.
[10]*Ibid.*, p.30.

Table 2-1. Degree of Concentration in the Food and Beverage Industry in Canada, 1965 (in Per Cent of Sales)*

Sector	Concentration of Sales (%)			
	Nat'l 4-firm	Reg'l 4-firm	Nat'l 8-firm	Reg'l 8-firm
Slaughtering and meat processors	58	76	68	96
Poultry processors	24	60	38	80
Dairy factories & cheese manuf.	25	67	35	81
Fruit & veg. canners & pres.	39	53	52	73
Flour mills	80	83	90	99
Bakeries	32	46	44	55
Confectionery manuf.	47	66	65	82
Misc. food manuf.	33	52	48	72
Soft drink manuf.	41	53	48	72
Breweries	95	93	99	100
Averages	47	65	59	81

*adapted from John W. Warnock, *Profit Hungry* (New Star Books, Vancouver, 1978), pp. 20-21.

Using Warnock's figures we see that the regional concentration levels are approximately 25% higher than the national levels at both the 4 and 8 firm levels in the Food and Beverage Industry as a whole. The figures indicate that "Breweries" and "Flour mills" are the most highly concentrated at both national and regional levels, although the "Slaughtering and meat processors" sector is also highly concentrated at the regional level. "Poultry processors" and "Dairy factories and cheese manufacturers" tend to be the least concentrated on a national level. At the regional level, "Bakeries" tend to be the least concentrated.

According to a scale drawn up by Bain'', the food and

''Warnock, p.17

beverage industry at the national 4 firm level, would constitute moderate concentration in a "low-grade" oligopolistic structure. The 65% regional concentration level could be termed a "high-moderate" to a "highly concentrated" oligopoly.[12]

In this case, it would appear that the food processing industry falls within the realm of an oligopoly, be it "high" or "low" level. However, in several sectors we have seen the number of plants decline considerably in the past twenty years, and concentration could be potentially much higher now, especially at the regional level.

Product Differentiation

> A general class of product is differentiated if any significant basis exists for distinguishing the goods (or services) of one seller from those of another. Such a basis may be real or fancied, so long as it is of any importance whatever to buyers, and leads to a preference for one variety of the product over another.[13]

As the definition implies, differentiation can be real or imagined. In Canada's processed fruit and vegetable industry, for example, Uhm and de Graaf[14] report that the advertising-to-sales ratio (the most common measure of image differentiation) was 2.97% in 1965. They consider this to be "moderately high". A more current example (although for the U.S.) showed General Foods' advertising to be 5.6% of sales

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[12]It is recognized that 4 and 8-firm concentration ratios are not the only, or necessarily the most preferred, measure of monopoly power. Such an examination would go beyond the scope of this discussion.

[13]Koch, p. 300

[14]Uhm and de Graaf, p.33.

in 1977[15]. The 1973 figures shown below indicate that the average is likely considerably above 2.97% (See Table 2-2).

Table 2-2. Advertising Expenditures of Some U.S. Corporations, 1973 (Expenditures and Per Cent of Total Sales)*

Food Corporation	Expenditures	As a % of Total Sales
General Foods	$180,000,000	8.1
Heublein	77,900,000	5.9
Coca Cola	76,000,000	3.5
General Mills	74,200,000	3.7
Kraftco	74,000,000	2.4
Nabisco	69,050,000	6.8
Hunt-Wesson	61,700,000	5.1
PepsiCo	58,000,000	4.4
Pillsbury	50,000,000	4.5
Standard Brands	50,000,000	4.5
Average		4.9

*Adapted from Warnock, p. 41.

Table 2-3 gives an account of the largest food and beverage advertisers in Canada in 1970.

> The food and beverage industry is by far the largest advertiser in both Canada and the United States. The high degree of advertising and brand promotion is a major factor in the growing monopoly concentration in the industry. The oligopolistic markets, characterized by a high degree of product differentiation, also provide a major stimulus to the rise of the conglomerate firm, for with the volume of advertising comes very substantial discounts.[16]

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[15]Koch, p.301
[16]Warnock, p. 31.

Table 2-3. Largest Food and Beverage Advertisers in Canada, 1970 (Ranked by Dollars Spent on Advertising)*

Rank	Company	Ownership/Control
2.	Proctor & Gamble of Canada	U.S.
3.	General Foods Ltd.	U.S.
4.	Canadian Breweries	U.K./S.A.
5.	IMASCO Ltd.	U.K.
6.	Warner-Lambert Canada Ltd.	U.S.
7.	Molson Industries Ltd.	Canada
10.	Kraft Foods Ltd.	U.S.
16.	Benson & Hedges Canada Ltd.	U.S.
18.	Lever Brothers Ltd.	U.K.
22.	Kellogg Co. of Canada	U.S.
26.	Nestle Canada Ltd.	Switzerland
27.	Coca Cola Ltd.	U.S.
28.	Standard Brands Ltd.	U.S.
33.	Labatt Breweries of Canada	Canada
35.	Seagrams Co. Ltd.	Canada
36.	Campbell Soup Co.	U.S.
37.	Dominion Stores Ltd.	Canada
39.	Quaker Oats Co. of Canada Ltd.	U.S.
42.	Salada Foods Ltd.	U.S.
45.	Wm. Wrigley Jr. Co. Ltd.	U.S.
46.	Hiram Walker-Gooderham & Worts	Canada
50.	Nabisco Ltd.	U.S.

*Adapted from Warnock, p. 32.

Even with the limited information that we have available in this area, it can be concluded that a considerable amount of product differentiation exists in the food processing industry.

Barriers to Entry

Stigler's definition of a barrier to entry is "...a cost of producing at some rate of output (or at any) rate

which must be borne by a firm which seeks to enter an industry, but which is not borne by firms already in the industry."[17]

Several factors can make effective deterrents to new firms entering a particular market. The standard list includes[18]: (1) scale economies, (2) product differentiation, (3) input supply control, (4) legal and institutional factors, (5) large capital requirements, and (6) technological factors. Product differentiation has been discussed in a previous section. A discussion on technology is provided in Chapter III.[19]

Scale Economies

"Scale-economy barriers to entry arise when firms do not achieve the lowest possible costs until they have grown to occupy a large portion of the national market."[20]

Using the fruit and vegetable processing sector as a proxy, the minimum efficient plant size was 0.5% and 1.1% of the national market, in 1966 and 1972[21], respectively. On a regional basis, these figures rose to 0.8% and 1.88%. Another study[22] showed that entry was fairly easy, in terms of capital requirement, with the

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[17]Koch, p. 96.
[18]Uhm and de Graaf, p. 33.
[19] With information available, some of these items cannot be covered in detail (or at all) for the Canadian food processing industry. This study attempts to generate data that further addresses some of these items.
[20]Caves, p. 24.
[21]Uhm and de Graaf, p. 33.
[22]*Ibid.*

exception of the baby food and soup industries. Generally the meat processing sector is considered to have excess capacity to curb entry[23] although most information is outdated and it is difficult to conclude what would now constitute an efficient scale of plant.

Input Supply Control

Without adequate raw food inputs, processors will undoubtedly face difficulties. For example, attempts to curb this risk in the U. S. had seen a rise in the number of vegetable farms owned by processing plants, that is, vertical integration through ownership. The trend has now shifted away from ownership and toward increased forward contracting of inputs.[24] Contract farming on an annual basis transfers much of the risk to the landowner who must provide all of the capital for production while operating under no guarantee of contract renewal in subsequent years.

In Canada, the case is similar. Large firms like McCain's Foods contract potatoes with local farmers under very strict terms (date, quality, quantity, price) and if the farmer is unable to meet his commitments, he pays the difference between his agreed-to price and the price the processor must pay on the open market.[25] In 1976, Empress Foods[26] in southern Alberta contracted all

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[23]Warnock, p. 48.
[24]*Ibid.*, p. 111.
[25]*Ibid.*, p. 112.
[26]Empress Foods is a subsidiary of Safeway.

of the bean crop, the majority of the peas, and 27% of the canning corn. Safeway bought almost all of the balance to be marketed fresh in their stores. While Uhm and de Graaf[27] point out that about 15 to 20% of total vegetable production for processing was supplied by corporate farms, we see that forward contracting may take on a much larger role.

Other Studies in Barriers to Entry

Green[28] cites work carried out in Canada by Eastman and Stykolt that showed low barriers to entry in fruit canning, while product differentiation existed in vegetable canning, creating low to moderate barriers. Beef packing was considered to have low entry barriers while pork packing was termed "low to moderate" with the restraint being economies of scale. Koch[29] cites comparable work conducted by Bain in the U.S. canning industry in which he found moderate to low barriers existing due to the effects of scale economies and absolute cost and capital requirement barriers to setting up new plants. He found "moderate to low" to "substantial" barriers existing as a result of product differentiation in the late 1950s. Barriers to flour milling and meat packing were found to be at similar levels.

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[27] Uhm and de Graaf, p. 33.
[28] Christopher Green, *Canadian Industrial Organization*, (McGraw-Hill Ryerson, Toronto, 1980), p. 61.
[29] Koch, p. 98.

Foreign Ownership

Foreign ownership plays an important role in Canada's food processing industry. Table 2-4 shows the ownership of the largest food and beverage firms in Canada.

As an overall conclusion for the industry, we see that only 5 of the top 15 food and beverage firms in Canada are actually Canadian owned and/or controlled.

Table 2-4. Largest Food and Beverage Companies in Canada (Omitting alcoholic beverages), 1971 (Ranked by Dollars of Sales)*

Rank	Company	Ownership/Control
1	Canada Packers	Canada - W.F. McLean
2	Burns Foods	Canada - R.H. Webster
3	Swift Canada Co. Ltd.	U.S. - Swift & Co.**
4	Maple Leaf Mills Ltd.	U.S. - Norris Grain Co
5	General Foods Ltd.	U.S. - General Foods Corp.
6	Kraft Foods Ltd.	U.S. - Kraftco.
7	Standard Brands Ltd.	U.S. - Standard Brands Co.
8	Beatrice Foods (Canada)	U.S. - Beatrice Foods Inc.
9	Silverwood Industries	Canada-Silverwood Family***
10	Lever Brothers Ltd.	U.K. - Unilever
11	Coca Cola Ltd.	U.S. - Coca Cola Co.
12	Proctor & Gamble (Canada)	U.S. - Proctor & Gamble Co.
13	Robin Hood Multifoods Ltd.	U.S. - Internat'l Multifoods
14	Intercontinental Packers	Canada - Mendel Family
15	Redpath Industries Ltd.	U.K. - Tate & Lyle Ltd.

*Adapted from Warnock, pp. 23-25.
**Swift's has recently been acquired by Gainers (Canadian)
***Now owned by Silcorp Limited

Summary

Summary based on publications surveyed

The structure of the industry is characterized by oligopoly at both national and regional levels. Likely the most accurate indicators of concentration are the regional figures, the most recent of which were found for 1965.

> ...both the U.S. Federal Trade Commission and the Director of Investigation and Research for the Combines Act are quick to point, national concentration figures can be very misleading. In many industries there is simply no national market. For most consumers, they must buy in a much more restricted local market.[30]

Product differentiation and advertising are likely playing a steadily increasing role in consumer preference, with the possible exceptions of fresh-packaged meats and produce. Barriers to entry have received little attention in recent literature, although some suspect that forward contracting by large firms with considerable market power is on the increase. As a result, large firms may possess the ability to negotiate for lower priced inputs than their smaller competitors.

Inadequacy of data

Analysis of industrial organization in an industry is difficult when based solely on previously published information.

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[30]Warnock, p. 19.

The section of this paper that examined industry concentration relied on 1965 data to indicate regional versus national levels of market power. Even the more current concentration information of Statistics Canada tends to overgeneralize. The SIC system can potentially group firms together that do not directly compete with each other, thereby lowering the degree of indicated concentration. The processed vegetable sector provides an excellent example of this:

> Heinz has a near monopoly on baby foods. Green Giant, Libby, and Del Monte are the dominant firms in canned vegetables, while Libby and Del Monte control the canned fruit market. Kraft dominates the area of jams and jellies. Canned soup ... is almost completely controlled by Campbell soup ... T.J. Lipton has a virtual monopoly in the dry soup field.[31]

The industry is segmented into separate specialty areas, and within each of these sub-categories much less competition exists. This type of analysis would go a step beyond regional concentration discussed earlier.

The section on product differentiation was based on 1965 levels of advertising, supplemented by some 1970 data. Any conclusions drawn would not reflect the impact of recent surges in use of cable and satellite television, radio, and printed media.

Barriers to entry in the processing industry were shown from previous studies to be relatively low. Unfortunately, these studies were carried out over twenty-five years ago, when conditions in Canada were

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[31] *Ibid.*, p. 107.

substantially different. The difference in market share that fruit and vegetable plants had to have, for example, to be efficient in 1966 when compared to 1972[32] (from 0.5% to 1.1% of national market in six years) has been shown, but, is this an exponential or arithmetic multiplier? There is no third data point to estimate a rate of growth.

The importance of imports and foreign ownership is seldom recognized in the Organization Theory literature because most of our references come from the U.S. However, in a country like Canada, where foreign investment and imports are high, we should know the short and long-run effects they are having on investment into research and development, competing Canadian-owned firms, and employment. Foreign investment generates costs and benefits to the host country, and only a sectoral analysis can indicate its net effect on the food processing industry.

The topic suggested by the title of this chapter has not been fully addressed. We know where the industry has been, but we do not fully know where it is or where it is likely to go. The published data stops short of providing a sound basis for structural analysis, while no current information has been found which examines market conduct or performance. The study of industrial organization links market structure to firm behavior and

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[32]Uhm and de Graaf.

industry performance, and unless the fundamental data requirements are met to carry on this analysis, no predictions on levels and effectiveness of R and D can be made. Even though no consensus of opinion exists today which outlines the most innovative and progressive market structure overall, further research into specific industries could conceivably generate such an answer.

Ettlie provides an appropriate closing to this chapter:

> With notable exceptions, few studies of the food industry have been undertaken, perhaps in part because it lacks the glamour of the more technological intensive industries.[33]

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[33] John E. Ettlie, "Policy Implications of the Innovation Process in the U.S. food sector.", *Research Policy*, (12, 1983, North-Holland), p. 240.

III. REVIEW OF STUDIES ON TECHNOLOGICAL INNOVATION AND POLICY

Introduction

This chapter provides a review of selected recent work carried out on technological innovation and policy and their importance to economic well-being. The results from previous research are presented in order to give some basis for interpreting the results of this study.

Ettlie Study

In 1982, Ettlie conducted a study in the United States which examined policy incentives that would encourage innovation in a mature (slow growth) industry; the food processing industry was chosen. His study was based on information gathered from questionnaires and interviews with food processing and food equipment and packaging supply firms. The initial survey consisted of 54 food equipment and packaging supply firms and 147 food processing firms. Follow-up interviews with 12 suppliers and 56 processors were also included in the study.

Propositions. Eight propositions (hypotheses) were developed for the food processing firms: [34]

1. Large organization size promotes innovation when radical technology and large capital investment are required.

2. Perceived environmental uncertainty causes the

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[34] John E. Ettlie, "Policy Implications of the Innovation Process in the U.S. food sector.", *Research Policy*, (12, 1983, North-Holland), p. 243.

development of a more aggressive technology policy. Objective uncertainty, which is not enacted, inhibits innovation.

3. An aggressive technology policy promotes radical innovation but not necessarily incremental change.

4. An aggressive technology policy promotes the concentration of specialists.

5. Product diversification into industries new to the firm promotes an organization's innovation rate.

6. The concentration of specialists promotes firm innovativeness.

7. Performance gaps result from environmental change and promote innovations.

8. The congruence between an organization and any particular technological innovation will predict the adoption of that innovation. Congruence is a function of key technology attributes as perceived by organization members.

After collecting the responses of the food processors, Ettlie found strong support for Propositions 1, 3, 4 and 8. Moderate support existed for Propositions 5 and 6. Partial support was found for Proposition 7 while support for Proposition 2 was weak.

Conclusions on structural features

Ettlie made some overall conclusions after conducting analysis on the information he gathered. He found that, in both the food processing sector and the equipment manufacturing sector, "...increasing size only up to a point enhances innovativeness."[35]

Six specific conclusions relevant to the food processing industry emerged. Generally, however, Ettlie

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[35]Ettlie, p. 225

considered the food processing sector

> "... less sophisticated in strategy formulation, and experiences greater performance gaps than supplier firms. Yet similar results emerge for food processing firms - both strategy and to a less(er) extent structure are the key leverage variables in the innovation process."[36]

The six specific conclusions are listed below:[37]

1. Large organization size up to a point (log of number of year-round employees) is significantly correlated with the availability of slack resources for innovation, and promotes both radical and incremental technological changes.

2. An aggressive technology policy is a necessary requirement for especially radical technological change - both product and process innovation. An in-depth self-study of policy and practices for firms in the industry is strongly recommended.

3. With respect to radical process and packaging change decisions, organizations that are more structurally complex, informal, and centralized are more innovative. Only complexity appears to be necessary for incremental change.

4. Provided that sufficient slack resources are available, performance gaps tend to promote innovation. Assuming that a performance gap can be created by an internal change in standards as well as by environmental uncertainty, then there is potential leverage in this variable.

5. When any particular, radical technological change is on the decision making agenda, the presence of a champion for the particular innovation is a significant, consistent predictor of adoption. To the extent that attitudes toward the innovation can be changed or maintained positive on certain key attributes (e.g. lack of complexity, trialability, compatability, relative advantage, flexibility, and suitability), among key (members) of the organization, this will also promote adoption.

6. An understanding of the needed consistency between growth strategy and structure appears to be paramount to organization innovation.

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[36] *Ibid.*, p.256.
[37] *Ibid.*

Government incentives

Ettlie submitted a list of 23 potential federal incentives to firms surveyed to obtain their impression of how effective such programs were expected to be. The potential incentives were:[38]

1. Direct grants for background research.
2. Cost-sharing on specific new projects.
3. Funding of demonstration projects.
4. Purchase of products by government.
5. Access to government labs for assistance.
6. Access to technical information.
7. Speed-up of regulatory process (decisions).
8. Clarification of regulations.
9. Tighter enforcement of regulations.
10. Loosening of regulations (e.g. standards).
11. Waiver of anti-trust technical cooperation among firms.
12. Cooperative research through a center or joint program.
13. Tax credits for innovation work.
14. Joint technical projects between government and firm.
15. Fast tax write-off for capitalized expenditures.
16. Government seed money for high-risk research.
17. Extension of life of patents.
18. Provision of venture capital at low interest.

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[38] *Ibid.*, p. 247.

19. Help in gaining access to foreign technology.
20. Improved patent application procedures.
21. Change in procurement procedures.
22. Easing procedures for foreign joint ventures.
23. Less paperwork in regulation compliance.

Supplier preferences

In the suppliers sector, the top 4 incentives chosen were:[39]

1. Fast tax write-off for capitalized expenditures.
2. Tax credits for innovation work.
3. Less paperwork in regulation compliance.
4. Speed-up of regulatory process (decisions).

The least preferred action was tighter enforcement of regulations.

Processor preferences

The food processors showed slightly different incentive preferences, although tax and regulation reforms were considered most important in both groups. The least preferred was again tighter enforcement of regulations. This group chose the following incentives to be most beneficial to their sector:[40]

1. Speed-up regulatory process (decisions).
2. Fast tax write-off for capitalized expenditures.
3. Clarification of regulations.
4. Tax credits for innovation work.

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[39] *Ibid.*, p.246.
[40] *Ibid.*

5. Less paperwork in regulation compliance.

6. (tie)

   Access to technical information.

   Provision of venture capital at low interest.

Policy recommendations

Ettlie analyzed both his structured and open-ended questions to formulate a set of joint policy recommendations for both the supply and processing sectors:[41]

1. The most desirable actions are those that make more investment capital at a lower interest rate available to this sector. This would aid food processors in adopting equipment and packaging that would make them more productive and stimulate suppliers to innovate in these product categories. (By one source, suppliers account for more than half the significant innovations in this sector);

2. large food processor and large supplier firm size is a justifiable condition for innovation in the food sector;

3. national innovation policy would be more effective if informed by an increased awareness and understanding of the technology strategy formulation process at the firm level;

4. although tax incentives for innovation are preferred by the sector, the results of this study do not unambiguously inform (support) innovation tax policy;

5. desirable regulatory reforms, especially in the areas that are extreme cost burdens to smaller firms, include the speed-up of the decision making process, and clarification and increased consistency of regulations (e.g., labeling);

6. dissemination of information on the innovation process is a desirable goal to be maintained by

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[41] *Ibid.*, p. 239.

government; and

7. any government actions that foster supplier-food processor collaboration for innovating purposes would be desirable.

CARC Report

The Canadian Agricultural Research Council (CARC) published a report in 1981 that reviewed two major studies (by Hamilton and Jones et al.) and various other articles that dealt with research and development in Canada's agriculture and food system[42]. The purpose of the CARC's initial involvement in this area of study was to assess

> ... the adequacy of the current programs of R & D conducted by both the private and public sectors in support of development and maintenance of a viable agriculture and food system to meet the needs of Canada's domestic and export markets.[43]

Recommendations

The study made recommendations concerning both the "agricultural production" and "processing, distribution, and retailing" sectors. The recommendations were subsequently approved by the Canadian Agricultural Services Coordinating Committee (CASCC). They are as follows:[44]

1. It is recommended that Agriculture Canada continue to work closely with provincial governments and producer organizations to develop a long-term

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[42]Canadian Agricultural Research Council, *Future Thrusts - Research and Development for Canada's Agriculture and Food System*, 1981.
[43]*Ibid.*, p. 1.
[44]*Ibid.*, p. 19.

agriculture and food strategy for the Atlantic region and other regions as required.

2. It is recommended that:
   a. Firms in agribusiness and food processing should play a stronger role in R & D and increase their R & D effort according to opportunity and climate of investment.
   b. Greater emphasis should be given to market-oriented research and a greater proportion of that translated into commercial opportunity in all sectors. Industry should contribute greater input to the formulation, allocation, and operation of R & D programs in the public sector.

3. It is recommended that a significant increase in funds and person years be given to the major performers of research, i.e. governments, universities, and industry. The resource base in agriculture and food must be increased. Agriculture Canada must continue to play a lead role.

4. It is recommended that Canada strive to increase the funding of research and development for agriculture and food by 66 2/3 percent over the next 5 years.

5. It is further recommended that:
   a. the level of 1.5% of GNP for Canadian R & D expenditures by all sectors be considered a reasonable objective over the next 5 years, although the consequent expansion of activity will severely tax the cadre of resource personnel associated with expanded graduate training, the present research commitments, and the available physical resources;
   b. efforts be accelerated to initiate new research thrusts to stop the erosion of the agricultural and food R & D capability that has occurred over the past decade of inadequate research funding.

ACARD Study

The Advisory Council for Applied Research and Development (ACARD) of London, England conducted a study[45]

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[45] *The Food Industry and Technology*, Her Majesty's Stationary Office, 1982, Amersham, England.

of their food industry in 1982. The study identified:[46]

1. constraints to the application of new technology in the food industry;
2. new market opportunities that might be exploited with the aid of new technology;
3. R and D implications.

A note on firm size and efficiency

Some interesting general comments made in the study concern the size of the largest firms and provide a good comparison to Canada's food processing industry[47]. Food manufacturing companies employing more than 500 workers employ over 80% of the sector's total work force. As well, the top 5 manufacturers of certain items account for 60 - 90% of the market. The top ten firms in the sector account for one-third of all food sales.

In terms of profitability (pre-tax profits as a percentage of sales), the U.K.'s large food companies are earning about 5% while their counterparts in the U.S. average 10%. Other problems are also evident in the U.K.'s food manufacturing industry, including:

> ... a lower level of overall (labour and capital) productivity than most major competing countries...per head, a much lower level of value added and investment, a slower growth of value added and a lower degree of efficiency in use of capital ... value added per worker in the U.K. was two-thirds that of West Germany, and less than half that of France.[48]

Resources devoted to R and D (in both budget and staff)

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[46] *Ibid.*, p. 3.
[47] *Ibid.*, p. 11.
[48] *Ibid.*, p. 13.

are also declining in the U.K. and this has been identified as a major contributor to their current problems[49].

Strong arguments were put forth throughout the paper which stressed 1) the need for the U.K. to be more competitive with other countries and, 2) the importance of increased R and D efforts.

Recommendation I

A call for the development of a strategy for food was made by ACARD.

> We recommend that the (sector) should develop a strategy for the food industry which recognises the role that new and existing technology could play in improving the industry's performance and putting it in a better position to exploit new and changing markets. We also recommend that the Department of Industry should stimulate innovation in the food machinery sector, perhaps in the first instance by publicising its existing process industry support schemes more widely. One specific measure to help exports of food machinery would be a nationally recognised certification or approval scheme, we recommend that the DoI together with the industry consider the establishment of such a scheme[50].

Recommendation II

Regarding the management of Government R & D, recommendations specific to the U.K.'s government organization were made. The general thrust of these recommendations, however, was based on current problems where "... universities and polytechnics, in particular,

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[49] *Ibid.*
[50] *Ibid.*, p. 36.

receive inadequate funds to build up centres of excellence or train sufficient numbers of technical, engineering, and research staff for the food industry."[51]

Recommendation III

Recommendation III deals with technology transfer.

> We recommend that MAFF (The Minister of Agriculture Fisheries and Food), as part of its sponsorship of the food industry, reviews these schemes to ensure that the food-based research associations and other bodies are effective in transferring existing and developing technologies into the food industry. We further recommend that, as part of its strategy for food, the Food and Drink Manufacturing EDC and the Food and Drink Machinery SWP should consider how industry could become more receptive to technology.[52]

Recommendation IV

In order to ensure an adequate information system for the food industry, ACARD made a final recommendation.

> We recommend that the Central Statistical Office together with MAFF investigate ways of attracting industrial funds for an improved NFS (National Food Survey), which in our view should embrace a complete food consumption survey and a nutritional survey.[53]

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[51] *Ibid.*
[52] *Ibid.*, p. 39.
[53] *Ibid.*

Discussion Paper-Alberta Economic Development and the Cabinet Committee on Science and Research Policy

The paper[54] cited below was prepared with the intention of "... encouraging new discussion on issues relevant to implementing a science and technology strategy for Alberta."[55] The paper consists of two separate parts. Part 1 is entitled "Science and Technology in Alberta's Future" and was prepared by the Research and Science Advisory Committee. Part 2 is entitled "Commercialization of Science and Technology in Alberta, A Proposal" and was conducted by the Department of Economic Development. Neither section of the paper dealt specifically with any manufacturing sector although the general thrusts could be applied equally to all industries.

Part 1. Our R & D activities-how they compare

The committee compared Canada's research and development to that of competing countries and found that we ranked seventh, behind the U.S.A., Japan, West Germany, France, the U.K., and Italy. Similarly, Canada spent 1.1% of its gross domestic product on R & D in 1980, ranking eleventh place and behind the U.S.A., Switzerland, West Germany, Japan, the U.K., the Netherlands, Sweden, France, Belgium and Norway.[56].

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[54] Alberta Economic Development and the Cabinet Committee on Science and Research Policy, *Science and Technology Development in Alberta - A Discussion Paper*, 1984.
[55] *Ibid.*, p. 1
[56] *Ibid.*, p. 8.

Within Canada, Alberta appears to be one of the provinces which contributes to our overall lag in R and D spendings. Only 0.80% of the gross provincial product was allocated to R & D in 1980 (although this improved, up to 1.1% by 1981-82).[57] Ontario, Quebec, and Atlantic Canada fare ahead of Alberta in their devotion to R & D. Other notable comparisons between Alberta and Canada as a whole show that Alberta ranked:[58]

-fifth in value added by manufacturing industry per capita,

-second in industrial R and D expenditure per employee,

-fifth in "graduate student index",

-sixth in sponsored research in universities per capita, and

-fourth in Federal science procurement contracts by province.

Research and Science Objectives of the Government of Alberta

In a response to support our industrial position, the objectives of the Alberta Government's research and science activities were set forth to:[59]

1. Support and promote the development of new technology that will maintain and enhance the productivity of existing economic activities;

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[57] *Ibid.*, p. 9.
[58] *Ibid.*, p. 10.
[59] *Ibid.*, p. 11.

2. Support and promote the development of new knowledge-based economic activities;

3. Support and encourage the development of human resources through new technologies and scientific discoveries, and by developing a better understanding of the interactions between society, science and technology;

4. Contribute to the advancement of scientific knowledge;

5. Develop the scientific base required to support health, environmental and other acts and regulations; and to

6. Develop and maintain skilled manpower within the Province in order to provide an adequate level of scientific and technical services.

No specific mention is made of the food processing sector, but it is assumed that this sector would be included as part of any such objectives.

Conclusions and Recommendations of the Committee

The committee made several closing statements based on their examination of the technological needs of Alberta industry. Their conclusions (Items 1 and 2) and recommendations (Items 3 through 5) were as follows:[60]

1. Although Alberta has a strong base in certain science and technology activities its competitors in international trade are even more research intensive.

2. Canada is generally weak in its ability to transfer research results from the laboratory to the marketplace.

3. A dual science strategy is needed[61]
   a. to develop and apply advanced technology for

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[60] *Ibid.*, pp. 16-19.

[61] A White Paper dealing with this recommendation was released during the late stages of this study. It was titled *Proposals for an Industrial and Science Strategy for Albertans-1985 to 1990*, by the Government of Alberta, 1984.

upgrading Alberta's traditional resource-based industries; and

b. to engage in high technology opportunities, that are identified by the private sector and encouraged, where appropriate, by joint industry/government initiatives. These opportunities in some cases will represent spin-offs from activities of the resource industries and in other cases will arise from advances and discoveries made by Alberta's growing population of trained scientists and engineers.

4. Improved mechanisms are needed in Alberta to establish R & D priorities and level of support.

5. Public understanding and support for R & D is essential.

Part 2

The proposal prepared by the Department of Economic Development stressed Alberta's inadequacy in terms of resources devoted to development of high technology[62]. This lack of support has forced scientists and major companies to locate in other regions, taking their expertise and funding with them. The paper went on to make several recommendations in a vane similar to those found in Part 1 discussed above. Their recommendations dealt with:

1. Organizing a Technological Development Authority Board to administer all government sponsored research and development,

2. Outlining the objectives of the Board,

3. Funding policy and funding implementation,

4. Creating an Alberta Innovation Centre with authority

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[62] *Ibid.*, p.22.

and expertise in the areas of patents, licensing, information, and so on.

Conclusions Based on Literature Reviewed

The specific conclusions of the investigations discussed in this chapter differed to some extent. However, an underlying theme was apparent throughout.

The Ettlie study looked closely at the U.S. food processing industry and discovered that aggressive, long-range technology policies combined with available slack resources are fundamental to stimulating innovativeness in the equipment supply sector. Similarly for the food processors, when resources are devoted to R & D, new products and processes will emerge. Policy preferences were clearly in favour of speeding up bureaucratic processes and recognition of risks taken by firms in R & D activities.

The CARC report suggested that more funds be allocated to R & D in all sectors: governments, universities, and industry.

The ACARD study provided the situation in the U.K. as a parallel to the position that Canada's food processing industry is in. As a result of R & D cutbacks and relaxed product and process development, the U.K. has found itself losing its ability to compete with neighboring countries. It recommended further efforts be made in funding and managing R & D in the food industry.

The Discussion Paper by Alberta Economic Development et al. showed Canada to be behind the U.K. and several other countries in its R & D spendings. Alberta tended to be between second and sixth (among the provinces) in its efforts to encourage R & D and innovation. Recommendations made in the paper echoed sentiments of papers discussed earlier: our competitors are more research intensive than we are and we had better improve our ability to take advantage of new opportunities.

A statement that reinforces the importance of an aggressive, coordinated plan of R & D and implementation is worth repeating:

> The importance of science and technology in enhancing Canada's productivity and improving Canada's competitiveness internationally must be recognized. Research and Development by themselves have little economic benefit. Their results have to be put in practice or commercialized in order for society to reap the significant benefits. Therefore, encouragement of research and development is necessary but not sufficient -- we must ensure that the adoption of new technology is not only encouraged but is, on balance, successful. While leadership in applied research and product innovation must rest with the private sector, governments can play an important role as catalysts in ensuring that Canada maintains the necessary capacity to engage in research, and to develop and adopt the new technologies which will be needed to maintain international competitiveness.[63]

The next chapter goes into specific government programs that are available to Alberta food processors.

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[63] Taken from Alberta Economic Development et al., p. 2. This passage, as cited above, was originally found in *Alberta in Canada: Strength in Diversity.*

IV. A CATALOGUE OF MAJOR GOVERNMENT INCENTIVE PROGRAMS

This chapter outlines the major federal and provincial programs that are aimed at providing incentives for Canadian manufacturers to innovate and invest in research and development. The most recent information available was obtained from various federal and provincial government agencies. This information was usually contained in brochures promoting or describing programs, discussion papers, and applicant information pamphlets. Also, a brief review of a recent task force report on federal incentive programs is provided.

Major Federal Programs

Programs for Industry/Laboratory Projects (PILP)

Objective

This program is administered by the National Research Council and it is designed to allow Canadian companies access to current technology developed or available at government facilities and Canadian universities. Canadian companies submitting projects, which are subsequently approved, will have access to government resources and university facilities, as well as access to any new knowledge arising from the project. Project support ranges from initial conception through to acceptability within the market.

Financial Support

In most cases, funding is through a contribution arrangement. However, procurement contracts are used occasionally. Under contribution arrangements, "... licenses will be arranged to allow the company the use of the government's background technology."[64] Development beyond the existing technology becomes property of the company. In contribution-based projects, "... companies are normally expected to absorb a substantial proportion of the costs."[65] In the case of procurement contracts, the government owns "all intellectual property" and will facilitate the issuance of licenses to the participating company.

Eligibility

Canadian companies demonstrating "financial, managerial, technical, production, and marketing capabilities can participate in this program."[66]

Selection Process

There are several criteria used in the selection process for proposals from Canadian-based companies. The major criteria are as follows:[67]

1. Level of government laboratories' involvement in proposal,

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[64]National Research Council (NRC), *Program for Industry/Laboratory Projects.*, p. 1.
[65]*Ibid.*
[66]*Ibid.*, p. 2.
[67]*Ibid.*

2. Economic benefit to Canada,
3. Potential market,
4. Qualified company management,
5. Enhancement of company R & D capability,
6. Level of company commitment,
7. Social benefits to Canada,
8. Level of technical and commercial risk,
9. Coincidence with national priorities,
10. Advancement of scientific knowledge,
11. Contribution to regional development.

Company Obligations

Under PILP, the company eligibility is directly related to the obligations. To fulfill its obligations, a company must:[68]

1. Carry out a research and development program that includes progress checkpoints or milestones,
2. Maintain good technical control and report to the government's project manager,
3. Maintain good financial control and report to the government's project manager,
4. Make a reasonable effort to commercialize the results in such a way as to maximize the benefit to Canada,
5. Report on the results of the commercialization program,
6. Contribute financially to the project and seek a license for federal background technology,
7. Assemble sufficient qualified staff and facilities to complete the project on schedule.

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[68] *Ibid.*

Under PILP, the government may agree to collaborate on and monitor programs, offer license, and allow access to federal facilities for company personnel.

Use of scientific and technical expertise from Canadian Universities

The firm can negotiate a sub-contract with a university as well as negotiate terms for the use of university-owned technology. Costs of licensing between the university and the firm "... will not be recognized as allowable costs in calculating either NRC's or the firm's portion of the total project costs."[69]

Industrial and Regional Development Program (IRDP)

This program is administered by the Department of Regional Industrial Expansion (DRIE). The IRDP is a consolidation of several programs which were formerly administered by the Department of Industry, Trade, and Commerce (DITC) and the Department of Regional Economic Expansion (DREE).

Objective

The IRDP aims at stimulating economic activity in all areas of Canada, as well as to enhance the international competitiveness of Canadian industry.[70] Such an objective would tend to help create jobs in slow

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[69] *Ibid.*, p. 8.
[70] Ministry of State, Science and Technology-Canada, *The Government of Canada's Support for Technology Development, 1984*, p.8.

growth regions and generate new technology. IRDP is aimed at small and medium-sized businesses. DRIE emphasizes regional needs. Funding under IRDP is based on a Development Index[71] which identifies and categorizes the regions of Canada into one of four tiers. Tier IV regions (regions of low development), when applicable, receive a maximum level of support, whereas tier I areas (most developed) receive only a basic level of support.

The Industrial and Regional Development Program is divided into six elements, each of which has criteria on establishing:

1. eligibility,
2. levels of support, and
3. methods of support for each stage of the project.

The six elements are identified as follows:[72]

1. Industrial Development Climate. Assistance is provided in such areas as:
   a. conducting studies pertaining to regional industrial development,
   b. establishing non-profit centres conducting or supporting work related to industrial development,
   c. infrastructure related to regional industrial development,
   d. scholarships and development of courses in

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[71] See Appendix I for a short description of this index.
[72] *Ibid.*, p. 9.

subject areas in which there is a deficiency, and

e. providing specialized services or disseminating scientific or technical information to benefit industrial development.

2. Innovation. Assistance for new product and/or process development is provided by studies aimed at technology transfer, market research, venture capital search, and industrial design. The goals are to increase productivity as well as international competitiveness.

3. Establishment. Support is provided for studies which deal with business and plant establishment projects. Priority is focused on the Tier IV regions.

4. Modernization/Expansion. Assistance is provided for studies on modernization, expansion, and adoption of state-of-the-art technology. Aid is also available for adopting new technology.

5. Marketing. Assistance is provided in marketing areas, such as:

   a. Market research and strategy studies,

   b. Assistance to organizations promoting Canadian products,

   c. Development of tourism markets,

   d. Program for Export Market Development (administered on behalf of the Department of External Affairs).

6. Restructuring. This element consists of studies on restructuring projects as well as actual business restructuring.

Financial Support

Support under IRDP takes the forms of loans, loan guarantees, repayable contributions, contributions, and grants. To qualify for assistance, a project must meet the following criteria:[73]

1. be commercially viable,
2. have national and regional economic benefit,
3. be projects that would not proceed without IRDP aid, and
4. assistance offered will be the minimum required to allow the project to proceed.

It is stressed that since public funds are involved, a maximum return is expected. As well, particular regional concerns will be considered carefully.

Western Transportation Industrial Development Program (WTID)

This program is administered by the Department of Regional Industrial Expansion (DRIE) and it is intended to augment existing programs such as IRDP. The WTID provides financial assistance for "...suppliers to railway and resource development projects, for food and agricultural

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[73]Government of Canada-Regional Industrial Expansion, *Industrial and Regional Development Program (IRDP), Background Pamphlet.*, p. 3.

processors, for industrial diversification projects and for related research and development."[74]. WTID is an opportunity for western businesses to take advantage of the "... economic opportunities resulting from the decision to revise the Crow's Nest Pass rate and expand the western railway system."[75]

The WTID program operates in much the same manner as the IRDP program by making use of the Development Index tier groups.

Industrial Research Assistance Program (IRAP)

This program is administered by the National Research Council (NRC) which has qualified personnel in 21 centres across Canada.

IRAP-P: Contributions to Large Projects

The objective of IRAP-P is "... to increase the calibre and scope of industrial research in Canada in situations where it leads to high business effectiveness with economic and/or social benefit to Canada."[76]

The objective is fulfilled by providing "... financial support for approved research workers engaged in approved industrial research projects of high technical merits showing prospects of high return and

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[74]Government of Canada, *Western Transportation Industrial Development Program (WTID)*
[75]*Ibid.*
[76]National Research Council of Canada, *Industrial Research Assistance Program: Information for Applicants*, p. 2.

with good business plans for achieving success."[77].

IRAP-P projects should embody the following points:

1. Be aimed at innovative products or processes within the company's abilities,
2. "...relate to research which in relation to the company's resources, is an unusually high risk, expensive, or longer range area, but where the potential benefits nevertheless appear large."[78],
3. Increase Canada's competitiveness in world trade by strengthening technological capabilities in a company's present or appropriate new field,
4. Encourage participation by both government and university scientists, and
5. "...assist the attainment of the objectives of the Canadian Government's industrial strategy as it may be formulated from time to time."[79]

A project must meet several goals and conditions. For example, projects must:[80]

1. be scientifically feasible,
2. be commercially realistic with regard to the applicant company,
3. be marketable (end product and process),
4. have "... an accessible market sufficient to justify exploitation in Canada."[81]

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[77] *Ibid.*
[78] *Ibid.*
[79] *Ibid.*, p. 3.
[80] *Ibid.*
[81] *Ibid.*

Projects ineligible for IRAP-P are projects in the geological and geophysical areas, market research, minor product developments or technical service activities.[82]

IRAP-C: Field Advisory Service

IRAP-C is designed to assist firms in acquiring or expanding "... a technological base necessary to ensure competitiveness and profitability of their operation."[83] This is a free "on site" service for Canadian companies with limited technical resources.

This program operates through a network of technical specialists in 21 key centers across Canada. The Industrial Technology Advisors, who have access to the resources of the Technical Information Service, provide information, increase technological awareness, solve technical problems and aid in assessing government assistance programs.[84] The advisors deal with concerns such as plant layout, production and cost controls, quality control, and materials handling. Advisors have diverse backgrounds (i.e. engineering, biology) and are able to address most problems or advise on a course of action. This could include advising clients on programs which may be applicable to their particular company.

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[82] *Ibid.*, p. 4.
[83] *Ibid.*, p. 7.
[84] *Ibid.*, p. 8.

IRAP-F: Technical Information Service

IRAP-F is useful to companies with "... limited technical facilities, staff or access to technical documentation."[85] Companies qualifying for assistance under IRAP-F receive personal service in solving specific problems. The staff have access to the latest scientific and technical information and are able to aid companies in the interpretation, use and adaptation of any new technology available. The overall result is a strengthening of Canadian industry by expanding technical capabilities. This service is provided free of charge.

"Assistance provided by IRAP-F has been directed to solving technical problems, improving production, developing new processes and products, and reducing costs."[86]

IRAP-H: Contributions to Firms Employing Undergraduates

This element of IRAP deals with problems of a short-term scientific, engineering or technical nature. Under IRAP-H, a company hires a university or technical college student for projects which are the equivalent of approximately one term in length. This program provides support to cover the student's salary and relocation expense (as set under NRC guidelines). The program encourages small to medium-sized companies with limited

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[85] *Ibid.*, p. 9.
[86] *Ibid.*, p. 10.

technical and engineering resources to undertake projects of a short-term nature.

IRAP-L: Contributions to Laboratory Investigations

Assistance is offered to small and medium-sized firms in short-term engineering and technical problems. The program is also aimed at improving production operations, expanding or enhancing the effective technology base through specialized external laboratory staff and facilities.[87] Projects accepted are geared to areas of "... project testing, project certification to recognized standards, product process design, value analysis or feasibility engineering to establish essential product functions and acquiring specialized expertise."[88] Financial assistance is based on a portion of the costs arising from the use of specialized services and equipment from various sources (i.e. research institutes, laboratories, universities, and consulting firms).[89]

Such short-term projects are expected to be carried out within a $6,000 budget. The level of assistance is set at 75% and, therefore, a maximum IRAP-L grant is $4,500. To be eligible, companies must be incorporated and have a maximum of 200 employees.

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[87] *Ibid.*, p. 15.
[88] *Ibid.*
[89] *Ibid.*

IRAP-M: Contributions to Small Projects

This program was established to encourage small companies to become involved with R and D projects. IRAP-M projects are those projects which would not have otherwise been carried out by the company.

IRAP-M offers technical and financial assistance, including salary costs of technical personnel, company employees and external research staff. The assistance to eligible staff (within and outside the company) establishes or expands a company's R and D department.

Duration of the project should not be more than 12 months and projects are preferred in the following areas:[90]

1. applied research and development,
2. preliminary engineering to establish design principles for a new product or process, and
3. process and product improvement or development to the point of technical feasibility.

The project must be scientifically feasible as well as commercially workable and market opportunities must exist for the new product or process. Selection of a project depends on the:[91]

1. impact of IRAP support in carrying out the project,
2. degree of novelty,
3. technical risk,
4. company commitment to the project, and

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[90] *Ibid.*, p. 19.
[91] *Ibid.*, p. 20.

5. company experience in marketing.

If a company decides to apply for this program, it must first discuss the project with a technical advisor who in turn offers advice, assistance, and required documentation.

Canadian Institute for Scientific and Technical Information (CISTI)

Operating under the National Research Council, CISTI offers library, acquisition, and storage services for materials covering scientific and technical areas. The information is made available to all sizes of firms. At minimal or no cost to the firm, CISTI will furnish regular reports tailored to specific firm needs.[92]

Educational Programs

Skills Growth Fund

This program was established by the Canada Employment and Immigration Commission (CEIC). It was designed to accelerate skill development and "... to help overcome serious shortages anticipated in technical and related occupations."[93] Funds are provided for establishment and upgrading of training facilities. Funding is also available to "... groups established to meet special training needs."[94] Once approved, capital

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[92] *Ibid.*, p. 14.
[93] *Ibid.*, p. 15.
[94] *Ibid.*

funding is available up to $40,000 per training place.

National Institutional Training Program

Under this program, "... the federal government buys courses tailored to meet the labour market's demand for skills and the needs of individual clients."[95] These courses are offered by provincial vocational schools, community colleges, and training centers which are operated by non-government organizations. Individuals taking these courses receive a training allowance or unemployment insurance benefits. The federal government will also fund expansion of "pre-apprenticeship training in national occupations."[96]

National Industrial Training Program (NITP)

This is a two-pronged program which operates under the Canada Employment and Immigration Commission (CEIC). The first element is General Industrial Training (GIT) which is designed to assist "... employers to meet their skill needs for workers in middle and higher level skills."[97] This is also a training program for adult workers who face barriers to future employment by upgrading skills to meet the challenges of industrial and technological change. The second element, Critical Trade Skills Training (CTST), is aimed at high skill occupations "... in which there will be a national or

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[95] *Ibid.*
[96] *Ibid.*
[97] *Ibid.*, p. 16.

regional shortage unless training efforts are increased."[98] Examples of tradespeople considered by this program include systems analysts, chemical process technicians, and industrial electricians.

Technology Support Through Procurement

This is a contracting-out policy that was established by the federal government in 1972. Requirements for "... mission-oriented science and technology are to be contracted out to the private sector, preferably to Canadian industry."[99] Departments seeking to fulfill requirements through foreign contracting must justify their actions because this program is intended to promote development of Canadian industrial R and D.

In 1974 the government expanded the contracting out policy to cover "unsolicited proposals (UP)". Industry submits science and technology proposals and if the proposal falls within "the mission of a government department", the department is able to react quickly to "sound, unique" proposals.

Final Comments on Federal Programs

There are several other programs that are managed by various government departments which cannot be fully covered in this section of the report.(e.g. The Source Development Fund (SDF) managed by Supply and Services). Some federal

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[98] *Ibid.*
[99] *Ibid.*

departments have programs designed to assist technology development in specific areas. Two examples of such department programs are 1) The New Crop Development Fund (NCDF), an Agriculture Canada program, and 2) The Industrial Energy Research and Development Program (IERD), which is an Energy, Mines and Resources Canada program.

R and D Tax Incentives

This section briefly outlines some of the principles on taxation and R and D. [100]

The majority of tax incentives focus on industrial R and D. The results of these R and D activities include job creation, improvements in both productivity and competitiveness, and increased export sales.

A consultation paper on proposed R and D tax policies identifies four principles:[101]

1. The private sector is in the best position to determine the amount and type of industrial R and D that it should undertake,

2. Incentives should not be used or set at a level to promote R and D activities that do not conform to sound business practice,

3. As much as possible, tax incentives for R and D should be of immediate benefit to firms, and

4. Tax incentives for R and D should be clear in their application and be as simple to understand and comply

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[100]It must be noted; however, that new budgets may invariably bring about both minor and major changes in the area of the tax system that deals with R and D incentives. It is also beyond the scope of this section to provide a comprehensive review of The Income Tax Act as it applies to R and D.

[101]Department of Finance, *R and D Tax Policies, A Paper for Consultation*, April, 1983, p. 1.

with as possible.

Tax incentives, therefore, have two effects on R and D:

1. Reducing taxes of firms performing R and D helps to increase after-tax cash flow, and
2. Tax incentives which make R and D more attractive in comparison to other activities of the firm tend to lead to a greater allocation of resources to R and D.[102]

In summary, the tax system, as opposed to grants and very specific aid programs, is considered to offer more general and universal incentives to support R and D.[103]

Provincial Programs

Several provincial departments have programs which are designed to aid technology development. For example, Alberta Agriculture has a Processing Development Assistance Program which is designed to improve the industry's awareness of new technology, productivity improvements, new products, marketing strategies, and package development. Information on the various programs can be obtained from the departments involved.

Task Force Report on Federal Policies and Programs for Technology Development - A Review

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[102] *Ibid.*, p. 17.

[103] On October 10, 1984, Federal Finance Minister Michael Wilson announced a moratorium on all scientific research tax credit investments. Source: The Edmonton Journal, October 11, 1984, *"Michael Wilson pulls plug on R & D tax vehicles"*, p. H5.

The programs available to Alberta food processors appear to meet many of the needs outlined in Ettlie's policy recommendations discussed in Chapter II. The National Research Council and others indicate that funds are available to firms of all sizes for innovation. Specific programs, such as IRAP-F and CISTI, are set up to address the problems of increased technical awareness and improved project planning. Tax credits are still available to firms who purchase new processing equipment. Ettlie's other points, large, high cost research projects and macro (provincial or national) policies, have also been addressed in the literature. Without an indepth examination of the effectiveness of the various programs and policies, it appears as though current government efforts are addressing the critical issues.

However, the Task Force on Federal Policies and Programs for Technology Development was able to identify general problems which would apply to the majority of federal and provincial programs. It should be noted that some of the their observations are in accord with responses received from the food processors surveyed in this study.

The first observation made by the Task Force was that "Most of these programs are attempts to 'push' on the innovation chain." [104] By sharing the costs and risks with private firms, it is felt that some R and D will be

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[104]Ministry of State-Science and Technology Canada, *Task Force on Federal Policies and Programs for Technology Development*, July, 1984, p. 8.

undertaken or at least encouraged.

A second observation made was that "Most programs are over-administered, and their responsibilities overlap."[105] Applicants are required to fill out a number of forms identifying the company, project outline, goals, and so on. The smaller companies tend to find the amount of paper work to be a barrier which stops them from applying for some of these assistance programs. This concern was echoed by a number of the smaller firms (responding to surveys for this study) who felt that the time and effort needed to find out about and apply for some programs was not worth the bother.

Once an application is made, "... the complexity of the procedures for evaluating applications, and in monitoring the resultant expenditures, are based on a laudable desire to avoid squandering public funds on dubious projects."[106] This tends to create a risk-averse system where the risk of the unknown is shared with administrators who are fully aware that the spending of public funds is being monitored. The Task Force points out that these programs should be designed to reflect the "... willingness on the part of government to share the risks of technology development."[107]

Very few programs have "... anything to offer start-up companies."[108] After reviewing the eligibility criteria of most programs, one finds that eligibility is based on how well a firm is established, its financial soundness and

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[105] *Ibid.*
[106] *Ibid.*, p. 9.
[107] *Ibid.*
[108] *Ibid.*

proven managerial and marketing skills.

The Task Force reports that the most successful programs are those administered by the National Research Council. This conclusion was based on a consensus of spokesmen who felt that programs such as IRAP and PILP worked well. A program which was deemed to be the "... least useful in promoting technology development is IRDP, administered by DRIE."[109] A comment made was that the National Research Council was more "in tune" with the client's needs whereas the IRDP program is administered by bureaucrats who have different goals in mind. As well, the IRDP program attempts to address both regional and technological development simultaneously. The Task Force notes that "... trying to serve both goals within a single program, namely IRDP, has created a frustrating situation in which neither goal is adequately served."[110]

Concluding Comments

At first glance, it appears as though there are government programs to encourage most innovative ideas that emerge in the food processing industry. In a closer examination, a Task Force found several inherent weaknesses in our current programs.

Many of the government programs have eligibility criteria which effectively rule out small and infant companies. Such companies may indeed be the dynamic force

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[109] *Ibid.*
[110] *Ibid.*

behind many new ideas which never are followed through to fruition. For this reason, government may be advised to welcome sound ideas based on potential for success and offer incentives and resources based on future returns rather than on a "proven track record" as it tends to now.

The bureaucratic paperwork delays are discouraging private sector participation. Smaller firms appear to be least able to deal with the documentation and conditions involved.

Finally, programs aimed at specific R and D activities may not have the appeal that a generous tax system has. Tax incentives may lend themselves more readily to creative, higher risk projects, as well as logically-directed research.

V. ATTITUDES OF THE FOOD PROCESSING INDUSTRY IN ALBERTA

Introduction

The questionnaire utilized in Phase II of this study consisted of four sections.[1] Section I was aimed at "Company Identification", describing types of ownership, location, products, and market. This section served to summarize much of the structural data collected. Section II of the questionnaire provided a "Research and Development Overview" which attempted to probe into the types and amount of R & D carried out by the individual firm. Section III looked at the "R & D Attitudes" of the firms surveyed. The questions were concerned with a) how important R & D is to their success, b) how susceptible to change the firm's products and processes were, and c) how Alberta and Canada compare with other countries in their levels of technological innovation. Section IV of the questionnaire consisted of two questions on "Government Involvement". These questions were attempting to ascertain what government R & D-oriented programs the individual company had been involved with.

This initial questionnaire was designed to be applicable to all processors regardless of size or product produced. The support of the Alberta Food Processors

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[1] A copy of the questionnaire discussed in this chapter is found in Appendix II. As a starting point, I made use of a questionnaire designed by Abenihun Ajao for her PH.D thesis, entitled *Firm and Product Age Distributions of Selected Growth Manufacturing Industries in the Prairies*, University of Alberta, 1983.

Association was solicited and received. The Association sent letters to 98 processors asking for their support and participation in this study.

Sample

The initial list of Alberta food processors was provided by Alberta Agriculture and it was considered to be the most complete and up-to-date list available. The population included processors of food for human consumption, livestock feed plants, soft drink manufacturers, distillers, wineries, and breweries. The distillers, wineries, breweries, and livestock feed plants were subsequently struck from the list, leaving a total sample of 254 food processors for inclusion in this study.[1][2]

Method of Analysis and Response Rate

Each question is discussed and analyzed individually in this section. The illustrative analysis carried out compares results obtained under both sectoral and size-based criteria. "Sectoral-based" analysis compares the results of the various food processing sectors (sectors differ by the types of products they produce). "Size-based" analysis compares results of groups based on their size, measured by

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[1][2]Distilleries, wineries and breweries were excluded from this study because alcoholic beverages are typically not considered to be "food". The number of firms in this sector is very few and only one major marketing channel, under government regulation, exists for alcoholic beverages.

number of employees per plant. By using these two "yardsticks" of comparison, a more accurate description of the industry is possible. A third type of comparison, based on income groups, was proposed but response to the income questions was too low to facilitate this grouping.

The total number of respondents to each question, as well as the percentage of respondents in each answer category will be included. The "n-value" cited in tables or figures refers to the total number of respondents replying to that particular question.

By the date set for analysis to begin on Phase II questionnaires, a total of 62 completed questionnaires had been received. Some of the potential respondents refused to participate because parent firms would not allow it. In other cases, questionnaires were forwarded to the head offices and never returned. A breakdown of the level of response per sector and per size category is shown in Table 5-1. Unfortunately, processor responses in the flour milling, poultry processing, and bakery sectors were both insufficient and unevenly distributed over the selected firm-size range to make any reliable observations for these sectors.

Table 5-1. Comparison of Respondent and Population Proportions, Alberta, 1984

Sector	Total/ Potential Respondents	Employee Grouping*	Population Proportion	Respondent Proportion
Meat	13/87 = 15%	A:	61/87=70%	9/13=69%
		B,C:	12/87=14%	4/13=31%
		D,E,F:	14/87=16%	0/13=00%
Vegetables	8/28 = 29%	A:	14/28=50%	5/8=63%
		B,C:	7/28=25%	1/8=13%
		D,E,F:	7/28=25%	2/8=25%
Oilseeds	5/7 = 71%	A:	1/7=14%	1/5=20%
		B,C:	2/7=29%	1/5=20%
		D,E,F:	4/7=57%	3/5=60%
Dairy	6/18 = 33%	A:	13/18=72%	4/6=67%
		B,C:	1/18= 6%	0/6=00%
		D,E,F:	4/18=22%	2/6=33%
Beverages	6/16 = 38%	A:	4/16=25%	1/6=17%
		B,C:	6/16=38%	4/6=67%
		D,E,F:	6/16=38%	1/6=17%
Honey	5/27 = 19%	A:	26/27=96%	5/5=100%
		B,C:	1/27= 4%	0/5=000%
		D,E,F:	0/27= 0%	0/5=000%
Misc.	11/41 = 27%	A:	31/41=76%	8/11=73%
		B,C:	4/41=10%	3/11=27%
		D,E,F:	6/41=15%	0/11=00%
Poultry	2/11 = 19%			
Bakeries	2/19 = 11%			
Flour	3/7 = 43%			

*Note: A = 1 to 15 employees/plant
B,C = 16 to 50 employees/plant
D,E,F = Over 50 employees/plant

Analysis

Analysis of Section I. Company Identification

Question I.1. What category of ownership best describes your company?

Table 5-2a outlines the six identified forms of ownership categories by sector.

Table 5-2a. Ownership in Alberta's Food Processing Industry, 1984 (by Sector)

Sector	Alternative Ownership* (%)							
	a	b	c	d	e	f	g	n
TOTAL	15	11	61	3	8	0	2	62
Meat	7	21	64	0	0	0	7	14
Vegetable	0	0	88	0	13	0	0	8
Oilseed	0	25	50	0	25	0	0	4
Dairy	40	20	40	0	0	0	0	5
Beverage	0	0	80	20	0	0	0	5
Honey	40	40	20	0	0	0	0	5
Misc.**	18	0	73	0	9	0	0	11

*Note: a = private unincorporated
b = partnership
c = incorporated company (private)
d = incorporated company (public)
e = incorporated cooperative
f = unincorporated cooperative
g = other

**Miscellaneous sector includes snack foods, confectioneries, spices, etc.

Table 5-2b outlines the ownership categories by size of plant.

Table 5-2b. Ownership in Alberta's Food Processing Industry, 1984 (by Plant Size)

Employees/ Plant	Alternative Ownership (%) a	b	c	d	e	f	g	n
1 - 15	21	14	61	0	4	0	0	28
16 - 50	6	6	78	0	6	0	6	18
Over 50	7	7	50	14	21	0	0	14

*Note: a = private unincorporated
b = partnership
c = incorporated company (private)
d = incorporated company (public)
e = incorporated cooperative
f = unincorporated cooperative
g = other

Of all the respondents, the largest group was represented by (c) incorporated company (private). The second most common form of ownership was (a) private unincorporated followed closely by (b) partnership. Very few of the respondents fell into (d) incorporated company (public) or cooperative (e or f) categories. Generally, the "big players" in the industry did not cooperate with this survey and this is reflected by the low turnout of category-d respondents. The large players who control much of the market appear to be reluctant to offer their opinions or concerns.

Examining ownership by size (Table 5-2b), we see that the largest plants responding are operated by private incorporated companies. As well, that group contains all public companies and the majority of cooperatives. The small plants tend to be run by incorporated private companies and unincorporated operators.

Question I.2. Where is your firm's general office located?

This question was aimed at ascertaining the level of geographic concentration that exists within Alberta's food processing industry. Figure 5-1 shows that the distribution of the respondents in the food processing industry tends to follow settlement patterns, with concentration in the largest centers, Edmonton and Calgary.

Question I.3. List the products your plant produces and indicate if demand is growing, constant, or declining.

The type of market demand facing a sector or group of plants is important in determining whether further growth is likely in that product category or whether economic problems are imminent. Tables 5-3a and 5-3b indicate the type of market demand in the identified sectors and plant size groupings.

Figure 5-1. Location of Respondents

Respondents to questionnaire

Table 5-3a. Demand for Processed Items in Alberta, 1984 (by Sector)

Sector	Market Demand (% of Products) Growing	Constant	Declining	products
Meat	53	34	13	53
Vegetable	67	33	0	18
Oilseed	75	25	0	8
Dairy	85	15	0	13
Beverage	56	44	0	9
Honey	18	46	36	11
Miscellaneous	62	35	4	26

Table 5-3b. Demand for Processed Items in Alberta, 1984 (by Plant Size)

Employees/plant	Market Demand (% of Products) Growing	Constant	Declining	products
A(1-15)	52	40	8	75
B,C(16-50)	62	32	6	50
D,E,F(Over 50)	68	27	5	37

Tables 5-3a and 5-3b examine the demand for processed items by sector and size, respectively. The majority of respondents felt that demand for their products was growing. However, honey processors showed a 36% response (based on products produced) in the "Market Demand Declining" category. Table 5-3b, which shows

responses by size of plant, draws attention to the fact that the largest plants have more growing markets than small firms do, and similarly, they have less products in the "declining" category.

Question I.4. During 1983, what percent of your plant capacity was being utilized?

This question was designed to examine the capacity level that the sectors and firms of different sizes were operating at. Tables 5-4a and 5-4b indicate the level of capacity that the groups were operating at in 1983. The values expressed are calculated to reflect percentage of capacity on a yearly basis (See formula below).

$$\frac{\text{Months} \times \% \text{ of Full Capacity}}{1200}$$

Table 5-4a. Average Operating Levels of Alberta Food Processors, 1983 (By Sector)

Sector	% of Full Capacity	n
TOTAL	60	60
Meat	70	13
Vegetable	48	8
Oilseed	65	4
Dairy	54	5
Beverage	58	5
Honey	55	5
Miscellaneous	55	10

Table 5-4b. Operating Levels of Alberta Food Processors, 1983 (by Plant Size)

Employees/plant	% of Full Capacity	n
1 - 15	55	27
16 - 50	60	17
Over 50	66	14

The operating levels (by sector) show that for the total industry, the "% of Full Capacity" was 60% in 1983. The meat sector was utilizing more plant capacity than any other sector, at 70%. The vegetable processors reported average capacity at 48%, which reflects the seasonality of their operations. This would also apply to the beverage and honey groups.

Table 5-4b shows that the large plants tend to be operating at higher capacities than the small ones, 66% versus 55%. This could be because of steadier markets and/or product diversification.

Questions I.5 - 9. Questions I.5 - 9 were answered through the use of a table which was designed to identify the company by its location in Alberta, number of food processing plants it operates, number of years

operating, remaining economic life (R.E.L.) of buildings and equipment, number and type (full-time, part-time, seasonal) of employees and products produced at each plant. The results are summarized in Tables 5-5a to 5-5c.

Table 5-5a. Analysis of Remaining Economic Life of Alberta Operations, 1984 (by Sector)

Sector	Average Years Operating	Average Building R.E.L.*	Average Equipment R.E.L.*	Plants
TOTAL	14.2	21.4	11.8	57-66
Meat	16.8	29.2	12.1	11-12
Vegetable	8.9	18.8	9.8	8-12
Oilseed	22.3	26.3	12.5	4
Dairy	8.1	25.4	13.1	7
Beverage	15.8	21.3	10.0	4-5
Honey	10.6	15.8	10.2	5
Miscellaneous	8.9	17.4	15.3	7-11

*Remaining Economic Life (R.E.L.) refers to the number of years the building or equipment are expected to remain reasonably competitive in the uses for which they were designed.

Table 5-5b. Analysis of Remaining Economic Life of Alberta Operations, 1984 (by Plant Size)

Plant Size	Average Years Operating	Average Building R.E.L.	Average Equipment R.E.L.	Plants
TOTAL	14.2	22.8	11.7	59-64
A(1 - 15)	12.7	20.7	10.9	25-27
B,C(16 - 50)	12.1	22.9	12.9	12-20
D,E,F(Over 50)	19.2	25.8	11.8	17

Some interesting conclusions can be drawn by studying Tables 5-5a and 5-5b. Table 5-5a shows us that the various processing sectors assign different life expectancies to their facilities. By adding "Average Building R.E.L." and "Average Years Operating", the total economic life can be ascertained. The responding food processors felt that, on the average, their facilities would remain viable for another 21.4 years, although this varied from 15.8 years to 29.2 years depending on the sector. "Average Equipment R.E.L." is 11.8 years for the industry, but varies between 10 and 15.25 years depending on the sector.

Table 5-5b shows the results by plant size. The "Average Years Operating" tends to be considerably greater for the larger plants than for the small and medium-sized ones, 19.2 years compared with 12.7 years. As well, "Average Building R.E.L." tends to increase as plant size increases. "Average Equipment R.E.L." shows no such trends, varying between 10.9 and 12.9 years.

Table 5-5c examines the percentage of plants in each employee group. The meat, honey, miscellaneous, and dairy sectors have the majority (64%, 100%, 55%, and 60%, respectively) of plants in the smallest group. The distribution of plants in the vegetable sector is approximately evenly distributed. However, the oilseed group shows the majority of plants to be in the largest group.

Table 5-5c. Distribution of Plants by Number of Employees, Alberta, 1984 (by Sector)

Sector	% of Plants in Each Employee Group		
	0 - 15	16 - 50	Over 50
Meat	64	21	14
Vegetable	25	38	38
Oilseed	25	0	75
Dairy	60	20	20
Beverage	20	60	20
Honey	100	0	0
Miscellaneous	55	46	0

Questions I.10-14. As in the previous case, a table was drawn-up to provide data in several areas. The respondents were asked to indicate relative importance of each product to the company, the market areas served, and sources of competition. The tables in this section list the major markets and sources of competition for Alberta's food processors by sector and size of firm.

Table 5-6a. Markets for Alberta Dairy Products, 1984

Market Area	% of Products Sold in Each Market	products
Alberta	88	13
Rest of Canada	12	13
International	0	13

Table 5-6b. Markets for Alberta Beverage Products, 1984

Market Area	% of Products Sold in Each Market	products
Alberta	92	5
Rest of Canada	8	5
International	0	5

Table 5-6c. Markets for Alberta Vegetable Products, 1984

Market Area	% of Products Sold in Each Market	products
Alberta	54	16
Rest of Canada	12	16
International	34	16

Table 5-6d. Markets for Alberta Meat Products, 1984

Market Area	% of Products Sold in Each Market	products
Alberta	85	34
Rest of Canada	11	34
International	4	34

Table 5-6e. Markets for Alberta Oilseed Products, 1984

Market Area	% of Products Sold in Each Market	products
Alberta	22	8
Rest of Canada	35	8
International	43	8

Table 5-6f. Markets for Alberta Honey Products, 1984

Market Area	% of Products Sold in Each Market	products
Alberta	66	8
Rest of Canada	27	8
International	7	8

Table 5-6g. Markets for Alberta's Miscellaneous Products, 1984

Market Area	% of Products Sold in Each Market	products
Alberta	78	20
Rest of Canada	17	20
International	5	20

Alberta tends to be the major market for most food products produced here. The demand from other provinces plays some role in all sectors. International markets play no part in the dairy and beverage sectors based on the respondents surveyed. While significant international markets appear for both the oilseed and vegetable sectors, it is the oilseed sector which is geared toward foreign demand.

Table 5-6h. Markets for Small (A) Processors in Alberta, 1984

Market Area	% of Products Sold in Each Market	products
Alberta	82	45
Rest of Canada	11	45
International	8	45

Table 5-6i. Markets for Medium (B,C) Processors in Alberta, 1984

Market Area	% of Products Sold in Each Market	products
Alberta	67	46
Rest of Canada	23	46
International	10	46

Table 5-6j. Markets for Large (D,E,F) Processors in Alberta, 1984

Market Area	% of Products Sold in Each Market	products
Alberta	59	38
Rest of Canada	25	38
International	17	38

Examining Tables 5-6h to 5-6j, we see that the smaller firms generally tend to be more dependent on local markets than the larger firms. Small firms indicate that approximately 82% of their products are being sold in the Alberta market. This drops to 67% and 59% for medium-sized and large plants, respectively. At the other end of the market, a higher percentage of the products from large plants are being sold outside of Alberta and Canada.

Tables 5-7a to 5-7j indicate the sources of competition being faced by Alberta's food processors. The responses are broken down by sector and size of plant.

Table 5-7a. Competition Facing the Alberta Meat Processors, 1984

Source of Competition	Level of Competition* 0	1	2	3	products
	(percent of products)				
Alberta	35	65	0	0	34
Rest of Canada	71	15	12	3	34
International	82	9	9	0	34

*Note: This ranking applies to Tables 5-7a to 5-7j.
0 = Not a source of competition
1 = Highest level
2 = Second highest level
3 = Lowest level

Table 5-7b. Competition Facing the Alberta Dairy Processors, 1984

Source of Competition	Level of Competition 0	1	2	3	products
	(percent of products)				
Alberta	31	69	0	0	13
Rest of Canada	92	0	8	0	13
International	92	0	0	8	13

Table 5-7c. Competition Facing the Alberta Beverage Processors, 1984

Source of Competition	Level of Competition 0	1	2	3	products
	(percent of products)				
Alberta	20	40	20	20	5
Rest of Canada	60	0	40	0	5
International	60	20	0	20	5

Table 5-7d. Competition Facing the Alberta Vegetable Processors, 1984

Source of Competition	Level of Competition 0	1	2	3	products
	(percent of products)				
Alberta	44	25	13	19	16
Rest of Canada	25	25	50	0	16
International	44	38	0	19	16

Table 5-7e. Competition Facing the Alberta Oilseed Processors, 1984

Source of Competition	Level of Competition 0	1	2	3	products
	(percent of products)				
Alberta	25	0	38	38	8
Rest of Canada	0	38	25	38	8
International	25	63	13	0	8

Table 5-7f. Competition Facing the Alberta Honey Processors, 1984

Source of Competition	Level of Competition 0	1	2	3	products
	(percent of products)				
Alberta	13	75	0	13	8
Rest of Canada	13	0	75	13	8
International	25	25	25	25	8

Table 5-7g. Competition Facing Miscellaneous Processors in Alberta, 1984

Source of Competition	Level of Competition 0	1	2	3	products
	(percent of products)				
Alberta	30	50	10	10	20
Rest of Canada	35	45	20	0	20
International	70	5	15	10	20

Table 5-7h. Competition Facing Small (A) Processors in Alberta, 1984

Source of Competition	Level of Competition 0	1	2	3	products
	(percent of products)				
Alberta	29	60	7	4	45
Rest of Canada	42	31	24	2	45
International	69	16	11	4	45

Table 5-7i. Competition Facing Medium-Sized (B,C) Processors in Alberta, 1984

Source of Competition	Level of Competition 0	1	2	3	products
	(percent of products)				
Alberta	46	39	2	13	46
Rest of Canada	44	30	26	0	46
International	59	15	15	11	46

Table 5-7j. Competition Facing Large (D,E,F) Processors in Alberta, 1984

Source of Competition	Level of Competition 0	1	2	3	products
	(percent of products)				
Alberta	24	42	26	8	38
Rest of Canada	42	29	18	10	38
International	57	21	5	16	38

Most sectors considered other Alberta processors to be their main source of competition. The notable exceptions occur in the vegetable and oilseed processing

sectors. In these two cases, the respondents felt that international competitors were their major source of competition.

Tables 5-7h to 5-7j rank the sources of competition facing the three different plant size groups. In all three groups, the competition within Alberta ranks highest, with "Rest of Canada" and "International" ranking second and third, respectively.

Question I.15. Approximately what percentage of your firm's gross revenue is derived from food processing activities in Alberta?

The tables below break the results into sectoral groups by products produced and size-based groups by number of employees in 1984.

Table 5-8a. Economic Importance of Alberta Operations to Firm, 1984 (by Sector)

Sector	% of Income from Alberta Operations	n
TOTAL	90	54
Meat	91	10
Vegetable	84	7
Oilseed	95	4
Dairy	90	5
Beverage	94	5
Honey	98	5
Miscellaneous	77	10

Table 5-8b. Economic Importance of Alberta Operations to Firm, 1984 (by Plant Size)

Employees/Plant	% of Income from Alberta Operations	n
TOTAL	90	53
1 - 15	90	23
16 - 50	89	16
Over 50	90	14

Tables 5-8a and 5-8b show the economic importance of the plants located in Alberta to the firm. Such a small percentage of respondents had parent firms located outside of the province that it is not surprising to see a high percentage of dependence on Alberta operations. However, some of the respondents are likely diversified into other business areas, including farming or retail, which may be responsible for keeping the food processing income at approximately 90% of the firm's total revenue instead of 100%. The value in the "over 50 employees/plant" category also reinforces the fact that large national firms refused to participate in this study.

Question I.16. What is your firm's approximate gross

revenue from food processing in Alberta?

No income figures can be published because of the low response rate to this question and the assurance of confidentiality to the respondents.

Analysis of Section II. Research and Development Overview

Question II.1. Does your firm employ a Research and Development Director? Yes or No and Where.

Table 5-9. Firms in Alberta Employing R and D Directors, 1984 (by Sector)

Sector	Firms Employing an R & D Director	n
TOTAL	9*	61
Meat	1	13
Vegetable	1	8
Oilseed	1	5
Dairy	4	6
Beverage	0	6
Honey	0	5
Miscellaneous	1	11

*The TOTAL includes one large flour mill which employs an R and D director at its head office.

As expected, few of the small firms employ R and D directors. The dairy sector tends to employ the largest proportion of R and D directors based on the survey group. In the case of dairy processors, the laboratory technician may be considered as the R and D Director.

Question II.2 Does your firm conduct any IN-HOUSE Research and Development? Yes or No and Where?

Table 5-10. Firms in Alberta Conducting In-House R and D, 1984 (by Sector)

Sector	Firms Conducting In-house R & D	n
TOTAL	24*	61
Meat	3	13
Vegetable	1	8
Oilseed	1	5
Dairy	5	6
Beverage	1	6
Honey	2	5
Miscellaneous	9	11

*The TOTAL includes two flour mills.

Again the dairy sector, as well as the miscellaneous processors, tend to lead in in-house research and development. It should be noted that the definition of "In-house R and D" can be construed to mean a variety of activities, and conclusions based on this table may be misleading.

Question II.3. What was your firm's approximate expenditure (including salaries and expenses) on the R & D that your firm conducted IN-HOUSE in years from 1980 - 1984?

Table 5-11. Expenditures on In-House R and D per Firm, Alberta, 1980-83 (by Plant Size)

Employees/Plant	Average Amount of In-house R & D/Firm* 1980	1981	1982	1983	n
	(dollars)				
A (1-15)	36	214	1464	1393	28
B,C (16-50)	2893	3117	4507	12722	18
D,E,F (Over 50)	9286	9643	12500	11071	14

*Averages over all firms in size group, including those conducting no In-house R and D.

Again, so few firms carry out in-house research and development that the values reported by the sectors cannot be published. Spendings are shown in Table 5-11 by plant-size group only. Even with this limited information, we see that the amount of in-house R and D generally increases as plant size increases. It is interesting to note that in 1983, the medium-sized firms equalled the large firms in in-house R and D spendings.

Question II.4. Approximately how many person-years did your firm devote to R & D conducted in Alberta in years between 1980 and 1984?

Ten respondents listed a value greater than 0 as the number of person-years their company devotes to R and D. These values ranged from 0.01 to 2.0 person-years in 1983. The dairy and flour sectors (according to a

very limited response) appeared to dominate in this area.

Question II.5. Does your firm hire OUTSIDE consultants to conduct R & D for you? Yes or No.

Table 5-12a. Firms in Alberta Hiring Outside Consultants, 1984 (by Sector)

Sector	Yes	No	n
	(percent of firms)		
TOTAL	20	80	50
Meat	15	85	13
Vegetable	14	86	7
Oilseed	50	50	4
Dairy	40	60	5
Beverage	20	80	5
Honey	0	100	5
Miscellaneous	18	82	11

Table 5-12b. Firms in Alberta Hiring Outside Consultants, 1984 (by Plant Size)

Employees/Plant	Yes	No	n
	(percent of firms)		
TOTAL	20	80	57
A(1 - 15)	7	93	27
B,C(16 - 50)	19	81	16
D,E,F(Over 50)	43	57	14

We see that only 20% of the respondents hire outside assistance to conduct their R and D. The most notable result of this question is that 43% of large firms hire outside R and D while only 7% of the small firms do.

Question II.6. Approximately how much did you spend on OUTSIDE R & D consulting in the years between 1980 and 1984?

Table 5-13. Expenditures on Outside R and D, Alberta, 1984 (by Plant Size)

	Average Outside R & D/Firm*				
Employees/Plant	1980	1981	1982	1983	n
	(dollars)				
A(1-15)	464	643	643	607	28
B,C(16-50)	91	91	182	5000	18
D,E,F(Over 50)	1714	1786	76214	9071	14

*Averaged over all firms in size group, including those hiring no outside R and D assistance.

Analyzing average incomes or spendings by sector is not practical because values span a wide range due to the great variability in plant and firm size. However, looking at the industry by plant size, we see that medium-sized firms spent less than the small firms during the period between 1980 to 1982. This trend may

have since reversed. The large firms spend the greatest amount on R and D and they have been increasing their expenditures over the last four years. The value for 1982 is large for the most part because of a major research effort undertaken by one firm in that year. Unfortunately, inadequate data is available to show the optimum size of plant from an R and D standpoint.

Question II.7. Where is most of your OUTSIDE R & D conducted?

Table 5-14a. Location at Which R & D Was Conducted, Alberta, 1984 (by Sector)

	Percent at Each R & D Facility				
Sector	University	Government	Independent	Other	n
TOTAL	0	33	59	8	12
Meat	0	33	67	0	3
Oilseed	0	0	100	0	1
Dairy	0	67	33	0	3
Beverage	0	0	100	0	1
Misc.	0	25	50	25	4

Table 5-14a indicates that most R and D is conducted by independent consultants or laboratories. Government is second, at about one-half the level of independents. It is worth noting that the reverse is true for the dairy sector, where government conducts

about twice as much R and D as the independent consultants.

Table 5-14b. Location at Which R & D Was Conducted, Alberta, 1984 (by Plant Size)

	Percent at Each R & D Facility				
Employees	University	Government	Independent	Other	n
A(1-15)	17	51	34	0	6
B,C(16-50)	0	40	60	0	6
D,E,F(Over 50)	0	33	67	0	3

When analyzing this question by plant size, we see that small plants tend to use government R and D more than independent consultants, 51% compared with 34%. As plant size increases, more work is carried out by independent groups and less direct government R and D is involved. The university was mentioned as a source of R and D by only one of the respondents.

Question II.8. Has your firm ever taken out any patents for any products and/or processes? Yes or No and For What.

Only 3 of the firms responding to this survey have ever taken patents out for processes they developed in Alberta. Such a small number of patents reported makes

analysis impossible.

Question II.9. Approximately how much did your firm spend on new processing equipment in Alberta between the years 1980 and 1983?

Table 5-15. Spendings on New Processing Equipment, Alberta, 1984 (by Size)

Employees/Plant	Spendings on Processing Equipment*				
	1980	1981	1982	1983	n
	(dollars)				
1 -15	12570	8214	7536	27250	28
16 - 50	45778	32500	41722	172333	18
Over 50	684071	945143	687143	527143	14

*Averaged over all firms in size group, including those spending nothing on new equipment.

Averaging by sector is of little use in this case as well. However, examining equipment spendings by plant size confirms expectations. We see that spendings by large plants tend to be many times greater than spendings of small plants, although the gap appears to be closing. Large firms are the only group showing declining spendings on new equipment consistently since 1981.

Questions II.10-14. Approximately what proportion of

your firm's R & D and equipment spendings are in the following categories?

This question was aimed at ascertaining what proportion of R & D and equipment spendings were in:

1. Introducing/developing new products
2. Reducing production costs on current products through new or improved processes
3. Maintenance and replacement (equipment spendings only).

Response to this question was not as high as expected making specific conclusions difficult to draw. This was likely because 1) such a small percentage of plants actually had R and D in their budgets, and 2) the plants that did spend on R and D spent relatively little. However, there was quite a clear indication again that large firms were more aware of the roles that R and D can play and they responded accordingly.

Question II.15. When your firm decides to purchase new processing equipment, where does it look to for a supplier?

Overall, for the industry, we see that local, national, and U.S. suppliers have about equal share of the food processing equipment market in Alberta. Based on the results, international firms have approximately 18% of the market. Table 5-16b points out that larger

plants tend to be equipped by U.S and national suppliers while small plants buy 37% of their equipment locally. This may be because the smaller plants are less specialized or they are not able to afford the costs of searching for suppliers outside the province.

Table 5-16a. Equipment Supplier Location, Alberta, 1984 (by Sector)

Sector	Equipment Source: Local-Alta	National	U.S.	Foreign	n
	(percent from each source)				
TOTAL	28	28	27	18	59
Meat	21	26	37	16	9
Vegetable	25	35	20	20	9
Dairy	0	33	33	33	1
Beverage	25	25	0	50	3
Honey	25	25	50	0	2
Misc.	36	25	21	18	15

Table 5-16b. Equipment Supplier Location, Alberta, 1984 (by Plant Size)

Employees	Equipment Source: Local-Alta	National	U.S.	Foreign	n
	(percent from each source)				
1 - 15	37	28	20	16	26
16 - 50	24	30	24	22	17
Over 50	20	29	37	14	14

Question II.16. In what ways do affiliation with a parent company and its manufacturing operations outside Alberta or Canada in general affect your company's/plant's R & D activities?

Listed below are the 6 alternative statements which could be applied to this question.

a. Parent guarantees (financially) R & D activities

b. Parent assigns which R & D activities are to be conducted

c. Parent makes available its foreign R & D activities

d. Parent does not influence company's R & D activities

e. Parent discourages/does not allow company to conduct R & D

f. Other (No parent firm)

Table 5-17a. Effects of Parent-Firm Affiliation, Alberta, 1984 (by Sector)

	Alternative Statement						
Sector	a.	b.	c.	d.	e.	f.	n
	(percent)						
Meat	7	7	0	0	0	86	14
Vegetable	0	0	0	0	0	100	9
Oilseed	0	0	25	25	0	50	4
Dairy	20	0	0	0	0	80	5
Beverage	20	0	20	0	20	40	5
Miscellaneous	0	0	0	0	0	100	11

Of the plants who responded in categories a through e (plants having a parent firm), no trend or conclusions appear obvious. Only one case appeared where the parent discouraged or did not allow a plant to conduct its own R and D. In the other cases, responses varied about proportionately in all sectors and plant-size groups.

Table 5-17b. Effects of Parent-Firm Affiliation, Alberta, 1984 (by Plant Size)

	Alternative Statement						
Employees/plant	a.	b.	c.	d.	e.	f.	n
			(percent)				
A(1 - 15)	14	14	0	0	0	71	28
B,C(16 - 50)	20	0	0	0	20	60	18
D,E,F(Over 50)	14	0	28	28	0	57	14

Analysis of Section III. R and D Attitudes

Question III.1. The following statements describe the role which R and D and innovation in general could play in a company's growth. Listed below are the four statements that were to be reviewed and checked as most applicable to the respondent's current situation.

a. Generating R & D/innovation in the near future is necessary for my company's survival.

b. Generating R & D/innovation is not crucial for survival, but is necessary if my company is to realize important economies of scale and thereby enhance the growth possibilities of my company in the near future.

c. Generating R & D/innovation is not likely to contribute to any of the goals of my company in the near future.

d. Generating R & D/innovation is likely to create more problems for my company than worthwhile results. My company is better off without any R & D/innovation.

Table 5-18a. The Roles of R and D and Innovation, Alberta, 1984 (by sector)

	Alternative Statement				
Sector	a.	b.	c.	d.	n
			(percent)		
Meat	40	40	20	0	10
Vegetable	25	50	25	0	8
Oilseed	0	75	25	0	4
Dairy	40	60	0	0	5
Beverage	25	75	0	0	4
Honey	0	100	0	0	5
Misc.	0	70	30	0	10

In the majority of cases, both in sectoral (Table 5-18a) and size-based groups (5-18b), generating R and D and innovation was considered '... not crucial for survival, but is necessary if my company is to realize important economies of scale and thereby enhance the growth possibilities of my company in the near future.' Very few respondents chose a negative response (d).

Table 5-18b. The Roles of R and D and Innovation, Alberta, 1984 (by Plant Size)

	Alternative Statement				
Employees	a.	b.	c.	d.	n
		(percent)			
1 - 15	9	74	17	0	23
16 - 50	33	39	22	6	18
Over 50	25	75	0	0	12

Question III.2. How much do R & D activities contribute to the following aspects of your company's performance? Participants were asked to consider: a) Total Profit, b) Growth of Sales, c) Stability of Sales and Income, and d) Reputation.

Note:

1. Substantially

2. Moderately
3. Slightly
4. No effect
5. Negative Effect

Table 5-19a. Opinions of Managers on the Effect of R and D on Total Profit, Alberta, 1984 (by Sector)

Sector	1	2	3	4	5	n
			(percent)			
TOTAL	16	34	28	19	3	32
Meat	25	0	25	50	0	4
Vegetable	20	40	40	0	0	5
Oilseed	25	0	50	25	0	4
Dairy	0	75	0	25	0	4
Beverage	50	50	0	0	0	2
Honey	0	75	25	0	0	4
Misc.	11	22	33	22	11	9

Table 5-19b. Opinions of Managers on the Effect of R and D on Total Profit, Alberta, 1984 (by Plant Size)

Employees	1	2	3	4	5	n
			(percent)			
TOTAL	24	29	26	18	3	38
A(1-15)	8	39	23	31	0	13
B,C(16-50)	36	7	29	21	7	14
D,E,F(50 +)	27	46	27	0	0	11

The largest single group of respondents considered R and D activities to affect their total profit "moderately" in both Tables 5-19a and 5-19b. The majority of answers fell in the slightly to substantially categories and we can conclude that R and D does positively contribute to total profit.

Table 5-19c. Opinions of Managers on the Effect of R and D on Growth of Sales, Alberta, 1984 (by Sector)

Sector	1	2	3	4	5	n
			(percent)			
TOTAL	22	28	13	38	0	32
Meat	25	0	25	50	0	4
Vegetable	20	40	20	20	0	5
Oilseed	25	0	0	75	0	4
Dairy	25	50	0	25	0	4
Beverage	0	50	50	0	0	2
Honey	0	25	25	50	0	4
Misc.	33	33	0	33	0	9

Table 5-19d. Opinions of Managers on the Effect of R and D on Growth of Sales, Alberta, 1984 (by Plant Size)

Employees	1	2	3	4	5	n
			(percent)			
TOTAL	23	23	21	33	0	39
A(1-15)	21	29	7	43	0	14
B,C(16-60)	29	7	29	36	0	14
D,E,F(50+)	18	36	27	18	0	11

The results of Tables 5-19c and 5-19d are difficult to interpret. The largest group, although not the majority, felt that R and D had no effect on growth of sales while the second largest group considered the effect to be moderate or substantial. Overall, it appears that respondents felt that R and D had some "limited" effect on growth of sales.

Table 5-19e. Opinions of Managers on the Effect of R and D on Stability of Sales and Income, Alberta, 1984 (by Sector)

Sector	1	2	3	4	5	n
			(percent)			
TOTAL	21	18	24	36	0	33
Meat	17	17	17	50	0	6
Vegetable	20	20	40	20	0	5
Oilseed	25	0	0	75	0	4
Dairy	25	50	0	25	0	4
Beverage	0	50	50	0	0	2
Honey	0	0	67	33	0	3
Misc.	33	11	22	33	0	9

The largest single group of respondents felt that R and D had little effect on stability of sales and income (Tables 5-19f and g). However, the balance of respondents' replies were evenly distributed over the slightly to substantially ranges. This would indicate that R and D is considered to have influence in these

areas.

Table 5-19f. Opinions of Managers on the Effect of R and D on Stability of Sales and Income, Alberta, 1984 (by Plant Size)

Employees/plant	1	2	3	4	5	n
			(percent)			
TOTAL	23	23	23	33	0	40
1 - 15	13	27	20	40	0	15
16 - 50	36	7	21	36	0	14
Over 50	18	36	27	18	0	11

Table 5-19g. Opinions of Managers on the Effect of R and D on Reputation, Alberta, 1984 (by Sector)

Sector	1	2	3	4	5	n
			(percent)			
TOTAL	26	19	26	29	0	31
Meat	25	0	25	50	0	4
Vegetable	0	40	40	20	0	5
Oilseed	25	0	50	25	0	4
Dairy	50	25	0	25	0	4
Beverage	100	0	0	0	0	2
Honey	0	0	67	33	0	3
Misc.	22	33	11	33	0	3

The sectoral analysis (Table 5-19g) shows the responses to be almost equal across the substantially, slightly, and no effect categories. This indicates that the overall majority considers R and D to have a positive effect on firm reputation. This is further substantiated by examining Table 5-19h, where 36% of respondents felt that the effect was substantial. A final interesting point is that as plants (firms) get larger, the perceived effect of R and D activities on their reputation increases.

Table 5-19h. Opinions of Managers on the Effect of R and D on Reputation, Alberta, 1984 (by Plant Size)

Employees/plant	1	2	3	4	5	n
			(percent)			
TOTAL	36	15	23	26	0	39
1 - 15	21	21	21	36	0	14
16 - 50	36	14	14	36	0	14
Over 50	55	9	36	0	0	11

Question III.3. To what extent does your PRODUCT(S) undergo changes? Please evaluate on a scale of 1 to 5 below, where:

1. Infrequent Product Change
2.
3. Moderate Product Change
4.
5. Continuous Product Change

In most sectors, the majority of respondents suggested that products produced in Alberta undergo infrequent change. The "miscellaneous" sector is likely the most progressive with 50% of the products in the "moderate product change" category. As well, products produced by large plants may be somewhat more subject to change than those produced at small plants.

Table 5-20a. Frequency of Product Change, Alberta, 1984 (by Sector)

Sector	1	2	3	4	5	products
			(percent)			
Meat	82	3	8	0	8	39
Vegetable	64	9	27	0	0	11
Oilseed	38	25	25	13	0	8
Dairy	50	36	14	0	0	14
Beverage	83	0	17	0	0	6
Honey	67	0	33	0	0	6
Misc.	50	0	50	0	0	14

Table 5-20b. Frequency of Product Change, Alberta, 1984 (by Plant Size)

Employees	1	2	3	4	5	products
			(percent)			
A(1-15)	69	4	22	0	6	55
B,C(16-50)	88	0	12	0	0	33
D,E,F(50 +)	50	21	21	3	6	34

Question III.4. To what extent does your PRODUCTION PROCESS(ES) undergo changes? Please evaluate on a scale of 1 to 5 below, where:

1. Infrequent Process Change
2.
3. Moderate Process Change
4.
5. Continuous Process Change

Table 5-21a. Frequency of Process Change, Alberta, 1984 (by Sector)

Sector	1	2	3	4	5	products
	(percent of products)					
Meat	66	11	16	0	8	38
Vegetable	57	14	7	14	7	14
Oilseed	29	43	29	0	0	7
Dairy	60	20	20	0	0	10
Beverage	67	0	17	0	17	6
Honey	67	0	33	0	0	6
Misc.	33	0	67	0	0	9

The responses for frequency of process changes were very similar to those for product change. In this case, however, a more distinct difference occurs between large plants and small plants (Table 5-21b). 21% of the large plants chose "Infrequent process change" while 69% of the small plants selected this category for their production processes. 59% of the processes in large

plants are in the "moderate" to "continuous" categories compared to 22% and 30% in the small and medium plants, respectively.

Table 5-21b. Frequency of Process Change, Alberta, 1984 (by Plant Size)

Employees	1	2	3	4	5	processes
		(percent of products)				
A(1-15)	69	9	18	0	4	45
B,C(16-60)	68	3	21	0	9	34
D,E,F(50+)	21	21	38	15	6	34

Question III.5. Do you feel that the level of technological innovation in food processing in Alberta is:

1. better

2. equal

3. worse, than in other provinces?

Table 5-22a shows that 66% of respondents considered Alberta to be as technologically advanced as other provinces. The degree differed, however, depending on the specific sector. The honey, dairy, and beverage groups felt Alberta was equal or better than other

provinces in technological innovation. The vegetable group considered Alberta to be worse than other provinces. 38% of the participants in the miscellaneous category considered Alberta to be worse as well.

Table 5-22a. Manager's Perceptions of Technological Advancement in Alberta as Compared to Other Provinces, 1984 (by Sector)

Sector	Alternative Response			
	better	equal	worse	n
	(percent)			
TOTAL	11	63	26	38
Meat	9	64	27	11
Vegetable	0	50	50	6
Oilseed	0	75	25	4
Dairy	67	33	0	3
Beverage	0	100	0	4
Honey	50	50	0	2
Miscellaneous	0	62	38	8

Table 5-22b, which shows responses by plant size, indicates similar results overall. However, we see that 25% of the smallest plants consider Alberta more innovative than other provinces. This is a different response than the two other groups, possibly because of the limited exposure small plants have to other provinces and markets.

Table 5-22b. Manager's Perceptions of Technological Advancement in Alberta as Compared to Other Provinces, 1984 (by Plant Size)

Employees/plant	Alternative Response: better	equal	worse	n
	(percent)			
TOTAL	11	66	23	47
1 - 15	25	50	25	16
16 - 50	0	72	28	18
Over 50	8	77	15	13

Question III.6. Do you feel that the level of technological innovation in food processing in Alberta is:

1. better

2. equal

3. worse, than in other competing countries?

When comparing the technological advancement of Alberta to other countries by sector, we see that 59% of of the respondents felt that Alberta was worse. Only 10% felt that Alberta was better and 31% considered it equal. Only 2 sectors suggested that Alberta was better in this aspect (Table 5-23a).

Table 5-23b indicates responses by size of plant. 56% of respondents considered the degree of technological innovation in Alberta to be worse than in competing countries. Only 8% of the respondents considered Alberta in the "better" category while 35% considered Alberta equal. The largest processors were of a strong opinion (62%) that Alberta was worse than other countries while 41% of the small processors were of this opinion.

Table 5-23a. Manager's Perceptions of Technological Advancement in Alberta as Compared to Other Countries, 1984 (by Sector)

Sector	Alternative Response			
	better	equal	worse	n
	(percent)			
TOTAL	10	31	59	39
Meat	30	30	40	10
Vegetable	0	0	100	6
Oilseed	0	25	75	4
Dairy	0	100	0	3
Beverage	0	25	75	4
Honey	33	33	33	3
Miscellaneous	0	33	67	9

Table 5-23b. Manager's Perceptions of Technological Advancement in Alberta as Compared to Other Countries, 1984 (by Plant Size)

Employees/plant	Alternative Response: better	equal	worse	n
	(percent)			
TOTAL	8	35	56	48
1 - 15	18	41	41	17
16 - 50	0	33	67	18
Over 50	8	31	62	13

Analysis of Section IV. Government Involvement

Question IV.1. Has your company made use of any government programs that stimulate R & D and innovation? Yes or No and What Program?

25 of the respondents reported making use of some type of government programs; however, response regarding the specific type and use of the programs was poor. In most cases, only a brief description of the specific project was given and "government sponsored" was listed as the "program".

Summary of Phase II

This phase of the research utilized the results of a questionnaire to meet several of the objectives listed for the study. Overall, the results were satisfactory. However, in some cases the responses did not meet expectations and no conclusive results could be drawn.

Company Identification

The questionnaire reviewed the structural aspects of the food processing industry. This included areas such as ownership patterns, products and product demand. It was revealed that the majority of respondents felt that the demand for their products was growing. The utilization of plant capacity varied from a high operating level of 70% to a low of 48%, reflecting which of the sectors made the greatest use of their plant's total capacity over the year (1983).

Remaining Economic Life

A review of the remaining economic life (R.E.L.) of both the buildings and equipment used for food processing in Alberta was also undertaken. The average number of years that the buildings of all respondents were expected to remain economically viable was 21.4 years. The R.E.L. of equipment was understandably shorter at 11.8 years. The average plant surveyed in the study has been operating 14.2 years in Alberta.

Markets

Each sector was analyzed for the percentage of products sold in its various market areas (i.e. Alberta, Rest of Canada, International). It was found that the majority of respondents reported the market for their food products to be in Alberta. International markets were reported for the oilseed and vegetable sectors, with the oilseed sector focusing to a larger extent on foreign demand. A consideration of firm size categories showed that the smaller firms in this study tended to be more dependent on local markets than the larger firms who were more diverse in their marketing strategies.

A review of sources of competition faced by the study firms showed that most respondents considered other Alberta processors to be their main source of competition. As mentioned earlier, it was again the oilseed and vegetable groups which reported strong competition from international sources.

The percent of income, for the responding firms, received from Alberta operations was very high (90% for the total respondents). This situation reinforces the importance of Alberta operations to the livelihood of Alberta food processors. The majority of respondents had interests in Alberta alone, with very few respondents having markets or competition from other areas.[113]

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[113]This bias in the report reflects the unwillingness of large national and multi-national food processing firms to cooperate in the study.

Research and Development Overview

Respondents were asked questions relating to the use of R and D directors, in-house R and D and outside R and D consultants. Only nine (9) of the respondents employed an R and D Director, of which some were employed full-time in that capacity while others performed other duties as well.

In-house R and D

The results from a question asking whether or not firms conducted in-house R and D were misleading. In fact many of the responses itemizing their "in-house R and D" could actually have been classified as something else. The number of respondents reporting to conduct in-house R and D were three (3) times the number of firms with R and D Directors.

In-house spending on R and D over a four year period indicated skewed results in favour of large plant size. As the plant (firm) becomes larger, more resources are devoted to research and development. Person-years devoted to in-house R and D ranged from 0.01 to 2 in 1983. Of the 10 respondents indicating a value, the dairy and flour sectors appeared to dominate.

Outside Consultants

The use of outside consultants by the respondents was also very limited. Only 20% of the firms reported having used such services. Of this segment, the large

firms (single or multi-plant) had the greatest percentage (43%) while only 7% of the consulting was done for small plants (1-15 employees). Spending on outside R and D varied considerably between the three sizes of operations. Medium-sized firms spent less than the small operations between 1980 and 1982, but they may have reversed the trend in 1983. The large firms consistently spent more than the small and medium -sized firms.

A question asking the source of outside R and D revealed that smaller firms tended to use government services more than those of independent consultants. The larger firms behaved just the opposite, making more use of independent agencies.

Only one firm reported employing university facilities to conduct R and D.

Sources of New Equipment

Respondents were asked where their suppliers of new equipment were located. Overall, local, national, and U.S. suppliers have about an equal share of the market, according to this survey. The analysis by respondent plant size indicated that the smaller firms purchased 37% of their equipment locally. While larger firms purchased only 20% of their equipment locally and 37% nationally. This situation can be partially explained by smaller plants being less specialized, or in some cases, unable to afford the cost and time involved in searching

for suppliers outside of the province. Large plants may be more specialized, and therefore, may be forced to look elsewhere for their equipment requirements.

R and D Attitudes and Innovation

This section of the questionnaire examined R and D attitudes as they pertained to certain aspects of the company (firm or plant). With respect to company growth, the majority of respondents felt that generating R and D and innovation was "... not crucial for survival, but is necessary if my company is to realize important economies of scale and thereby enhance the growth possibilities of my company in the near future." The meat and dairy processors had the greatest percent (40% each) responding "... generating R and D/innovation in the near future is necessary for my company's survival." The vegetable, oilseed, and miscellaneous groups reported 25, 25 and 30%, respectively, that "... generating R and D/ innovation is not likely to contribute to any of the goals of my company in the near future."

Respondents were then asked how much R and D activities contribute to several aspects of their company's performance. The food processing industry, as a whole generally considered R and D activities to contribute "moderately" to their total profits. Some respondents, however, felt that R and D activities had no effect on profit.

There was a mixed response when assessing the effects of R and D on **growth of sales.** The largest group of respondents reported "no effect". The next largest group considered the contribution to be between "moderate" and "substantial".

The contribution of R and D to **reputation** by sector yielded responses which were evenly distributed between the "substantially", "slightly", and "no effect" categories. However, the size analysis did show that as plants get larger, the perceived effects of R and D contributions on reputation also grows.

Product and Process Changes and Innovation

Using the set of questions designed for this section, we see that both products and processes generally undergo infrequent changes. The larger plants reported a greater percentage of product and process changes than the smaller operations. The majority of respondents in the "small" category reported infrequent change.

Respondents were also asked to comment on whether or not Alberta's level of technological innovation was "better", "equal" or "worse" than other provinces and other countries. 63% of the respondents felt that Alberta was equal to other provinces while 26% felt that it was worse. However, the honey, dairy, and beverage groups felt that Alberta was equal or better than other provinces in its level of technological innovation. The

meat, vegetable and oilseed sectors responded 27, 50, and 25%, respectively, that Alberta was worse.

When comparing Alberta to other countries, 59% of the sectoral response felt that Alberta was lower in the adoption of new technology. The size analysis showed that, while a 62% majority considered Alberta worse off, only 41% of the small plants considered this to be the case.

VI. RESEARCH AND DEVELOPMENT NEEDS OF ALBERTA FOOD PROCESSORS

Questionnaires II and III, which were utilized in this phase of the study, required qualitative answers. The main goal of this part of the research was to identify Research and Development areas which were most important to food processors in Alberta.

Results of Questionnaires II and III

Introductory Comments

Questionnaire II was divided into two parts.[114] Part A dealt with questions about present concerns and attitudes while Part B examined the future prospects and directions of the industry. Response to Part A was good. However, responses to Part B did not meet expectations. Respondents generally did not address questions about future issues. This was likely because efforts were focused on maintaining a viable operation and little time is left to be concerned about other matters.

It was ascertained, however, that many of the respondents did actively attempt to stay informed of current technology. Issues such as office automation and computerization were often cited as directions for the

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[114]A copy of Questionnaire II is found in Appendix III.

future.

Sample

The second and third questionnaires[115] were sent to the same sample of 254 Alberta food processors that was used in the first round.

Method of Analysis and Response Rate

The format of the tables in this chapter is generally the same as in the previous one. Table 6-1 describes the population and the sectors within it. As well, a comparison is provided to indicate the relative distribution of the respondents when compared to the population. The "respondent proportions" appear to be similar to the "population proportions" for all sectors except poultry, bakeries, vegetable and beverage which showed too low a response rate or too skewed a distribution to enable any meaningful analysis. A total of 49 and 45 responses were received for questionnaires II and III, respectively. In the majority of cases, it appears as though the same respondents participated for the duration of the study, as Tables 5-1 and 6-1 indicate.

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[115]A copy of Questionnaire III is contained Appendix IV.

Table 6-1. Comparison of Respondent and Population Proportions, Alberta, 1984

Sector	Total Respondents	Employee Grouping*	Population Proportion	Respondent Proportion
Meat	14/87 = 16%	A:	61/87=70%	9/14=64%
		B,C:	12/87=14%	2/14=14%
		D,E,F:	14/87=16%	3/14=21%
Oilseeds	3/7 = 43%	A:	1/7=14%	1/3=33%
		B,C:	2/7=29%	0/3=00%
		D,E,F:	4/7=57%	2/3=67%
Dairy	5/18 = 27%	A:	13/18=72%	3/5=60%
		B,C:	1/18= 6%	0/5=00%
		D,E,F:	4/18=22%	2/5=40%
Honey	4/27 = 15%	A:	26/27=96%	4/4=100%
		B,C:	1/27= 4%	0/4=000%
		D,E,F:	0/27= 0%	0/4=000%
Flour	4/7 = 57%	A:	3/7=43%	2/4=50%
		B,C:	1/7=14%	0/4=00%
		D,E,F:	3/7=43%	2/4=50%
Misc.	11/41 = 27%	A:	31/41=76%	8/11=73%
		B,C:	4/41=10%	3/11=27%
		D,E,F:	6/41=15%	0/11=00%
Poultry	0/11 = 00%			
Bakeries	3/19 = 16%			
Vegetables	3/28 = 11%			
Beverages	2/16 = 13%			

*Note: A = 1 to 15 employees/plant
B,C = 16 to 50 employees/plant
D,E,F = Over 50 employees/plant

Analysis

Question A.1. Please list the products your firm produces and specify the plant locations.

This question had been covered by Questionnaire I but some new respondents were likely to be involved in this round and sector identification was still needed at this stage. Most sections discussed in the balance of this chapter divide the responses into sectors, based on information gathered from this question.

Question A.2. Do you consider your food processing sector to be technologically innovative? Please check.

Table 6-2a. Innovation in the Food Processing Industry, Alberta, 1984 (by Sector)

Sector/Degree*	1	2	3	4	5	n
			(percent)			
WHOLE INDUSTRY	5	9	65	9	13	46
Meat	7	13	67	13	0	15
Oilseed	0	33	33	0	33	3
Dairy	0	0	80	0	20	5
Flour	0	0	100	0	0	4
Honey	0	0	50	25	25	4
Miscellaneous	14	0	71	0	14	7

*See scale at bottom of Table 6-2b.

Table 6-2b. Innovation in the Food Processing Industry, Alberta, 1984 (by Plant Size)

Employees/Degree*	1	2	3	4	5	n
			(percent)			
WHOLE INDUSTRY	4	9	65	9	13	46
A(1-15 employees)	4	4	62	12	19	26
B,C(16-50)	0	10	70	10	10	9
D,E,F(Over 50)	10	20	70	0	0	10

*Note:
1 very innovative
2
3 moderately innovative
4
5 not innovative

Examining Table 6-2a, we see that the majority of respondents (65%) considered their sectors to be "moderately innovative". Only 5% of the respondents thought their sector was "very innovative". Meat processors and the miscellaneous group of processors were the only two groups with responses in the "very innovative" category. Looking at the extreme columns (1 and 5), we see that a greater proportion of the respondents felt that their processing sector was "not innovative". Reasons given will be discussed in later questions.

Table 6-2b looks at the industry by size of plant. We see that the largest plants are more apt to view themselves as technically innovative. This is in agreement with other studies which showed that larger firms were able to be more innovative. Smaller firms (A-group) tend to perceive

themselves as "moderately" to "not innovative". Medium-sized firms (B,C) tend to concentrate more at the "moderately innovative" to "not innovative" categories.

Question A.3. What factors do you consider important when asssessing the feasibility of introduction of a new product or process? Please rank.

Note: The third questionnaire was designed to provide a final ranking of the lists obtained from questions in the second questionnaire. The first column of numbers shows the current ranking of items, while the numbers in brackets indicate the ranking given to items in Questionnaire II.

The factors listed below were the responses given as being the most important when assessing the feasibility of introducing a new product or process. They are listed in order of importance assigned by the respondents.

1. (1) Size of market,
2. (3) Profitability,
3. (2) Cost and availability of inputs (labour, materials),
4. (4) Start-up costs,
5. (5) Integration with existing processes and equipment,
6. (7) Product quality,
7. (6) Level of competition in similar product/processes,
8. (8) Government support.

There were only minor changes after re-ranking the above factors. "Size of market" remained the most important, while "Profitability" became the second most important factor, replacing "Cost and availability of inputs". Other changes were "Product quality" being placed ahead of "Level of Competition".

Question A.4. Does your firm normally budget for R & D?

Table 6-3a. Proportion of Plants Budgeting for R & D, Alberta, 1984 (by Sector)

Sector	Yes(%)	No(%)	n
WHOLE INDUSTRY	20	80	46
Meat	21	79	14
Poultry	0	0	0
Vegetable	33	67	3
Oilseed	0	100	3
Dairy	40	60	4
Bakeries	25	75	4
Flour	25	75	4
Beverage	0	100	2
Honey	0	100	4
Miscellaneous	14	86	7

Table 6-3b. Proportion of Plants Budgeting for R & D, Alberta, 1984 (by Plant Size)

Employees/Plant	Yes(%)	No(%)	n
WHOLE INDUSTRY	20	80	46
A(1-15 employees)	7	93	27
B,C(16-50)	20	80	10
D,E,F	56	44	9

Respondents in this study did not generally budget for R and D (Table 6-3a). In the overall analysis, we see that approximately 20% of the respondents budgeted for R and D while the balance did not. Of the firms that did allow R and D in their budget, the funds allocated in many cases tended to be relatively small.

When looking at budgeting for R and D by size of firm (Table 6-3b), the percentage of respondents budgeting for R and D increases as number of employees increases. This would reflect the likelihood that the larger firms have the resources (financial, manpower) to devote to R and D work on a regular basis.

Question A.5. If you conduct R & D, where (in an accounting sense) do you derive your funds from?

Nine of the 49 respondents to this survey actually budgeted for R & D. These respondents indicated that the

costs were included under several categories, including their marketing budgets, selling costs, R & D budgets, company profits, general operating funds, and government grants. Too few firms actually budget for R & D to get any specific indications about the sector or optimum firm size that conducts most of the research, although the larger plants showed more tendency to actually include R and D in their budgets.

The firms who do not regularly budget for R & D but conduct R & D on an ad hoc basis generally derive their funds from company profits. Less frequently cited monetary sources were shareholder and bank loans and expected profits of the new product being developed.

Question A.6. Do you feel that further R & D would be worthwhile in your sector? Please check.

Table 6-4a reflects sectoral responses toward further R and D and whether or not it is worthwhile. Overall, 65% of the respondents felt that further R and D would be worthwhile (sum of respondents indicating a 1, 2, or 3.) The majority of respondents in the various sectors felt that further R and D would be worthwhile,except for the oilseed sector.

Table 6-4a. Manager's Perceptions of Worthiness of Further R & D, Alberta, 1984 (by Sector)

Sector/Degree*	1	2	3	4	5	n
			(percent)			
WHOLE INDUSTRY	30	12	23	12	23	43
Meat	31	8	23	23	15	13
Oilseed	0	33	0	33	33	3
Dairy	0	50	25	25	0	4
Flour	0	0	100	0	0	3
Honey	75	0	0	0	25	4
Miscellaneous	33	0	33	0	33	6

*See scale at bottom of Table 6-4b.

Table 6-4b. Manager's Perceptions of Worthiness of Further R & D, Alberta, 1984 (by Plant Size)

Employees/Degree*	1	2	3	4	5	n
			(percent)			
WHOLE INDUSTRY	30	12	23	12	23	43
A(1-15 employees)	38	4	21	13	25	24
B,C(16-50)	30	0	20	10	40	10
D,E,F(Over 50)	11	44	33	11	0	9

*Note: 1 very worthwhile
2
3 moderately worthwhile
4
5 not worthwhile

Many of the respondents who took the time to comment on this question stressed the need for further R and D. These comments reflected the responses of the open-ended questions discussed later.

Reviewing the figures for the responses by firm size (Table 6-4b), it was shown that 88% of the large (D,E,F) firms and 63% of the small (A) firms viewed further R and D as being worthwhile. The responses from the medium-sized firms reflected mixed feelings about how worthwhile they considered R and D to be.

Question A.7. If you consider R & D worthwhile, in what areas is more research needed?

The respondents who considered R & D worthwhile identified the following areas that required more research:[116]

1. (2) New product development
2. (1) Quality improvements in products
3. (3) Development of new equipment and production processes
4. (4) Product presentation and packaging
5. (5) Education programs(for company and government personnel)
6. (6) Improvements in waste use

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[116] Although the definition of R & D specifically did not include market research, several respondents listed "Market development and expansion" as an area requiring further research.

The re-ranking of the responses to this question revealed only one change. Respondents felt that "New product development" was more important than "Quality improvements in products".

Question A.8. What deterrents now exist which prevent or lessen your company's ability to invest in more R & D? Please rank.

The deterrents cited most often and highest ranked are listed below.

1. (1) Lack of funds for R & D coupled with the high cost of borrowing
2. (5) Small firm size
3. (3) Start-up costs associated with new product or process
4. (4) Lack of R & D facilities
5. (2) Lack of qualified personnel
6. (6) General economic conditions
7. (7) Risk
8. (8) Tax laws and government regulations

After re-ranking the deterrents which respondents considered to lessen a company's ability to invest in more R and D, the list shows that "Small firm size" was placed second instead of its previous fifth-place ranking. "Lack of qualified personnel" moved from second to fifth.

Question A.9. Do you consider organized research pools (where several company's resources are pooled together to conduct research in a common area) to be an effective way to conduct research and development in your sector? Please check.

Table 6-5a. Perceived Effectiveness of Research Pools, Alberta, 1984 (by Sector)

Sector/Degree*	1	2	3	4	5	n
			(percent)			
WHOLE INDUSTRY	24	7	31	19	21	42
Meat	8	0	31	23	38	13
Oilseed	67	0	0	0	33	3
Dairy	0	20	60	20	0	5
Flour	0	0	33	67	0	3
Honey	75	0	0	25	0	4
Miscellaneous	17	33	33	17	0	6

*See scale at bottom of Table 6-5b.

Table 6-5b. Perceived Effectiveness of Research Pools, Alberta, 1984 (by Plant Size)

Employees/Degree*	1	2	3	4	5	n
			(percent)			
WHOLE INDUSTRY	24	7	31	19	21	42
A(1-15 employees)	29	8	29	17	17	24
B(16-50)	11	0	44	11	33	9
D,E,F	22	11	11	31	21	9

*Note: 1 very effective
2
3 moderately effective
4
5 not effective

Table 6-5a shows the perceived effectiveness of research pools by sector. It appears that the largest single group of respondents consider research pools as being "moderately effective". The next largest group (24%) felt that such an approach to R and D would be very effective; however, a group of a similar proportion (21%) considered research pools to be "not effective". Overall, 62% of respondents considered research pools to be "moderately effective" to "very effective".

Table 6-5b looks at perceived effectiveness of research pools by plant size. 66% of the respondents in group A (1-15 employees) considered research pools to be "moderately effective" to "very effective". Medium-sized plants (16-50) did not have as favourable an outlook on the effectiveness of research pools; 55% thought they were in the "moderately effective" to "very effective" range. The large plants (with over 50 employees) showed a 44% minority opinion that research pools were "moderately effective" to "very effective". In this question, one can observe that the negative view of research pools increases as plant size (and likely concentration) increases.

Question A.10. Have you ever participated in a research pool? Yes or No. If "yes", please check how effective you consider it to have been.

Table 6-6a. Success with Research Pools, Alberta, 1984 (by Sector)

Sector/Degree*	1	2	3	4	5	n
			(number of plants)			
WHOLE INDUSTRY	2	2	3	2	0	9/43
Meat	0	0	0	1	0	1/14
Oilseed	0	1	1	0	0	2/3
Dairy	1	0	1	0	0	2/5
Flour	0	0	0	0	0	0/4
Honey	0	0	1	0	0	1/4
Miscellaneous	1	1	0	1	0	3/6

*See scale at bottom of Table 6-6b.

Table 6-6b. Success with Research Pools, Alberta, 1984 (by Plant Size)

Employees/Degree*	1	2	3	4	5	n
			(number of plants)			
WHOLE INDUSTRY	2	2	3	2	0	9/43
A(1-15 employees)	1	1	1	2	0	5/26
B,C(16-50)	0	0	0	0	0	0/9
D,E,F(Over 50)	1	1	2	0	0	4/8

*Note: 1 very effective
2
3 moderately effective
4
5 not effective

The 9 respondents with experience in joint projects or research pools generally responded favourably. 2 of the 9 chose degree 4 (moderately effective to not effective) while the balance responded more favourably. Based on the limited number of firms that have had experience with research pools, the perceived effects were more negative than the actual experiences of the participants. This is a positive sign for anyone wishing to become involved in a research pool.

Question A.11. Could government take any further action to stimulate technological change in your processing sector? Yes or No. If "yes", please rank. If "no", please comment.

17 out of 49 respondents (34%) felt that government should not take any further actions to stimulate technological change. Of the respondents who felt that government could take further actions to stimulate technological change in their sector, the following areas were identified.

1. (2) Low interest loans / cost sharing / direct funding,
2. (1) Technical advice / facilities / education (technical training),
3. (3) Tax incentives,
4. (4) Relaxing of tariff laws to allow foreign equipment into Canada,
5. (5) Insure steady supply of raw materials.

The only changes in this question were the alternating of items 1 and 2. It appears that "Low interest loans/cost sharing/direct funding" are more important than "Technical advice/facilities/education (technical training)" in stimulating technological change.

Question A.12. What, if any, types of R & D should government be involved in?

The following items were identified as the areas of R & D that government should be or should get involved in.

1. (1) New product development,
2. (4) Large R & D projects which are too costly for small firms to fund,
3. (3) Improved production processes along with equipment development,
4. (2) Quality improvements,
5. (5) Distribution of knowledge and research results,
6. (6) Training programs.

In the re-ranking of this question, "New product development" remained the most important area considered for government involvement. Changes included the re-ranking of "Quality Improvements" to the fourth position from second and "Large R & D projects which are to costly for small firms to fund", to second.

Question A.13. Do you consider current government programs to be adequate for your firm's needs? Please check.

Table 6-7a. Perceived Adequacy of Government Programs, Alberta, 1984 (by Sector)

Sector/Degree*	1	2	3	4	5	n
			(percent)			
WHOLE INDUSTRY	14	8	38	16	24	37
Meat	17	17	33	17	17	12
Oilseed	0	0	33	33	33	3
Dairy	25	25	0	0	50	4
Flour	25	0	75	0	0	4
Honey	0	0	100	0	0	2
Miscellaneous	0	0	40	20	40	5

*See scale at bottom of Table 6-7b.

Table 6-7b. Perceived Adequacy of Government Programs, Alberta, 1984 (by Plant Size)

Employees/Degree*	1	2	3	4	5	n
			(percent)			
WHOLE INDUSTRY	14	6	39	17	25	36
A(1-15 employees)	9	5	36	18	32	22
B,C(16-50)	29	0	29	14	29	7
D,E,F(Over 50)	13	25	50	13	0	8

*Note: 1 very effective
2
3 moderately effective
4
5 not effective

60% of the respondents felt that current programs were "moderately effective" to "very effective". The other 40% felt that the programs were "not effective".

Table 6-7b shows adequacy of government programs by plant size and exhibits some notable points. 88% of the respondents representing large plants considered programs to be "moderately" to "very effective". This may reflect the ability of large firms to direct resources into investigating and taking advantage of available assistance. As well, they would likely have little difficulty in meeting the eligibility criteria set by the government. The middle group (B,C) showed 58% of the responses to be in the "moderately effective" to "very effective" category. The A (small plant) group showed a response of only 44% in the "moderately effective" to "very effective" range. This may be explained by some comments given that the time and effort needed to investigate and apply for government programs is a barrier to small companies. As well, many of these firms may have difficulty meeting the eligibility criteria set out.

Question A.14. Please list the current government (provincial or federal) programs you are aware of that are oriented towards R & D in your sector.

Only 15 of the respondents were aware of any government programs or research incentives, and of these, 9 programs were mentioned. One respondent alone listed 6 programs while a common 3 programs were listed by the balance of the

respondents.

Some of the respondents included in this group of 15 included those who mentioned the facilities at Leduc and Lacombe, and grants in general. It appears that the food processors who responded to the questionnaire were not aware of the potential sources of assistance available to them when planning to undertake Research and Development projects.

Questions A.15 and A.16. What efforts did government make to inform you of these current programs? How did you become aware of these programs?

The 15 respondents who were aware of some type of government assistance cited several sources of information; brochures, trade shows, liason officers, newspapers, word of mouth, and personal enquiries were all listed with about equal frequency.

Question A.17. Do you feel that government efforts to inform food processors of current programs have been adequate? Please check.

Table 6-8a. Perceived Adequacy of Government Efforts to Inform, Alberta, 1984 (by Sector)

Sector/Degree*	1	2	3	4	5	n
			(percent)			
WHOLE INDUSTRY	3	8	30	13	45	40
Meat	0	8	23	23	46	13
Oilseed	0	0	33	0	67	3
Dairy	0	50	0	0	50	4
Flour	25	0	50	0	25	4
Honey	0	0	67	33	0	3
Miscellaneous	0	0	43	14	43	7

*See scale at bottom of Table 6-8b.

Table 6-8b. Perceived Adequacy of Government Efforts to Inform, Alberta, 1984 (by Plant Size)

Employees/Degree*	1	2	3	4	5	n
			(percent)			
WHOLE INDUSTRY	3	8	30	13	45	40
A(1-15 employees)	0	4	29	13	54	24
B,C(16-50)	14	0	29	14	43	7
D,E,F(Over 50)	11	22	33	11	22	9

*Note: 1 very effective
2
3 moderately effective
4
5 not effective

The trend of the responses by plant size is similar to question A.13. That is, 66% of the large firms found

government efforts to inform them of programs to be in the "moderately effective" to "very effective" range. 43% of the medium-sized firms viewed the efforts to be in this range. Only 33% of the A-group's responses were found in the "moderately effective" to "very effective" range.

The responses to this question indicated that the majority of small and medium-sized food processors were not satisfied with government efforts to inform them of the programs and resources available. 45% of the industry respondents felt that government efforts in the communication area were "not effective" while only 3% of the respondents were at the other end of the scale, stating government efforts to be "very effective".

Question A.18. What disadvantages affect the ability of food processors in your sector to be more competitive? Please rank.

A common set of responses surfaced from processors in all sectors and they have been ranked in the list below.

1. (1) Small domestic population / small Canadian food processing industry / lack of access to export markets,
2. (3) Costs of equipment and labour,
3. (2) Transportation costs,
4. (4) Lack of capital for R & D,
5. (5) Lack of government financial support,
6. (6) Low international prices,
7. (7) Marketing boards / government regulations,

8. (8) Low value-added products.

The only change made to this list after re-ranking was switching items 2 and 3, moving "Transportation costs" to third and "Costs of equipment and labour" to second.

Question A.19. Do you feel that technological change is important in improving Alberta's position in food processing? Please check.

Table 6-9a. Perceived Importance of Technological Change, Alberta, 1984 (by Sector)

Sector/Degree*	1	2	3	4	5	n
			(percent)			
WHOLE INDUSTRY	53	13	26	5	3	39
Meat	42	17	33	8	0	12
Oilseed	33	0	33	0	33	3
Dairy	0	20	80	0	0	5
Flour	75	25	0	0	0	4
Honey	33	67	0	0	0	3
Miscellaneous	83	0	17	0	0	6

*See scale at bottom of Table 6-9b.

Table 6-9b. Perceived Importance of Technological Change, Alberta, 1984 (by Plant Size)

Employees/Degree*	1	2	3	4	5	n
			(percent)			
WHOLE INDUSTRY	53	13	26	5	3	38
A(1-15 employees)	50	17	25	4	4	24
B,C(16-50)	67	0	17	17	0	6
D,E,F(Over 50)	44	22	33	0	0	9

*Note: 1 very important
2
3 moderately important
4
5 not important

Respondents to this question, for the industry as a whole, considered technological change to be very important to improving Alberta's competitive position in food processing. In all, 92% responded in the "moderately important" to "very important" categories. 53% of the respondents chose the "very important" category for this question.

Based on size or sector, all groups tended to be in agreement, the majority of respondents in any one category responded in the "very important" category.

Question A.20. What areas, if any, do you consider more important than technological change in improving your sector's competitive position? Please rank.

The list below is a composite of common areas considered more important than technological change.

1. (1) Development of both domestic and export markets,
2. (3) Lowering transportation rates,
3. (4) Upgrading skills of workers,
4. (5) Quality improvements,*
5. (2) Changes in government regulations,
6. (6) Cost reduction/streamlining existing procedures,*
7. (7) Advertising.

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*Some items listed in response to this question may be considered as variations of technological change, but were re-ranked nonetheless reinforcing the importance of technological change in it various forms (i.e. "quality improvements" and "cost reduction/streamlining existing procedures").

Respondents re-ranked several of the items in this question. "Changes in government regulations" moved to fifth from second place. "Lowering transportation rates" moved to second from its previously third position. It should be noted that in almost all questions where "government regulations" are listed, no specific regulation is referred to by the respondents. However, in many cases, the ranking of "Changes in government regulations" has dropped after the reordering in the third questionnaire, thereby lessening its importance.

This list points out that some marketing and regulatory changes may need to be made before further resources are

allocated to R and D. It is logical that expanded markets (Item 1) would encourage these firms.

B. Future

Question B.1. What types of incentives would your company need to encourage you to conduct more R & D? Please rank.

These are the types of incentives identified by respondents which would encourage more R and D.

1. (1) Availability of grants from government,
2. (3) Reduced tax burden on small companies to increase their competitiveness
3. (9) Low interest loans,
4. (4) Expanded foreign and domestic markets,
5. (7) Government cost-sharing with firms,
6. (5) Decreased financial risk for small companies,
7. (6) Increased availability of qualified personnel,
8. (8) Publication of available government programs,
9. (10) Development of research pools where practical,
10. (2) More freedom from government controls.

The list of incentives compiled for this question underwent considerable re-evaluation. The most notable change is seen in the placement of the previously ninth-place item, "Low interest loans", to third position. As well, the originally second-ranked item, "More freedom

from government controls"(whatever controls they may be), moved to tenth place.

Question B.2. What NEW PRODUCTS do you foresee being introduced in your processing sector in the next 2 to 5 years (short run) and the next 5 to 10 years (long run)? Please list and rank by likelihood of occurrence.

Perhaps because of the current economic uncertainty facing Alberta's food processors, responses to this question were not as insightful as expected. Most processors did not have any response regarding expected new products in the long-run. The short-run responses very often cited products that are already being produced by other processors in the industry. It is also likely that many more products are planned but are deemed confidential and were not divulged to us.

Some of the new products that were mentioned are listed below.

Table 6-10. New Products Foreseen In Alberta Food Processing In the Short-Run (2 to 5 years)

Meat: meat loaves, rendered fats, sausage items, canned hams, jarred items, packaged beef liver, smoked meat products, packaged meat meal, more convenience items, nutritive processing, health foods

Poultry: nil

Vegetable: improved vegetable varieties

Oilseed: meal protein improvements, moderate seed yield

increases

Dairy: new beverages, new ice cream novelties, new cheeses

Bakeries: specialty mixes

Flour: improved refining, decreased baking time flour

Beverages: non-alcoholic wine

Honey: better bee strains

Miscellaneous: nil

Table 6-11. New Products Foreseen In Alberta Food Processing In the Long-Run (5 to 10 years)

Meat: lard processing, more vacuum packing, buffalo slaughtering, consumer-sized deli packaging

Poultry: nil

Vegetable: nil

Oilseed: significant seed and oil yield improvements with hybrid varieties

Dairy: sodium-reduced butter and cheeses, cold-spreadable butter, artificial cheese products

Bakeries: new bread types

Flour: new varieties, more frozen dough products

Beverages: nil

Honey: nil

Miscellaneous: irradiated foods

Question B.3. What NEW PROCESSES do you foresee being

introduced in your processing sector in the next 2 to 5 years (short run) and the next 5 to 10 years (long run)? Please list and rank by likelihood of occurrence.

Response to this question was similar to Question B.2. Long-run process changes in almost all cases were not foreseen or not divulged. The new processes that were mentioned are listed below.

Table 6-12a. New Processes Foreseen in Alberta Food Processing in the Short-Run (2 to 5 years)

Meat: computer processing, bacterial control processing, increased chemical and curing technology, shelf-life extension processes

Oilseed: better extraction methods, cold pressing, improved energy efficiency

Bakeries: increased automation, micro-processing

Flour: computerized quality control, better packaging

Table 6-12b. New Processes Foreseen in Alberta Food Processing in the Long-Run (5 to 10 years)

Bakeries: radiation for increased shelf life, increased computerization, different packaging

Flour: further computerization

Miscellaneous: Micro-baking

Question B.4. List what you consider to be the main

objective(s) for developing new production processes. Please rank.

Listed below are the most often cited and highest ranked objectives considered when developing new production processes.

1. Cost reduction
2. Increase Consumer Demand
3. Increased Quality
4. Increased Productivity
5. Increased Profit

Question B.5. What directions (in terms of products and/or processes) do you feel food processors in your sector should pursue to improve their position? Please rank.

1. Increase product quality
2. Decreased cost per unit of production
3. Standardization
4. Increased efficiency from equipment and personnel
5. Decreased energy waste and better use of waste products

The responses to this question stress the importance of new technologies that will enable processors to pursue these new directions.

Question B.6. Do you feel that your food sector in Alberta has the potential to become a leader in developing new food products and processes? Yes or No and why or why not?

Table 6-13a. Opinions on Whether or Not Alberta Can Become a Leader in Food R and D, 1984 (by Sector)

Sector	Yes(%)	No(%)	n
WHOLE INDUSTRY	68	32	34
Meat	6	4	10
Oilseed	67	33	3
Dairy	80	20	5
Flour	67	33	3
Honey	100	0	2
Miscellaneous	80	20	5

Table 6-13b. Opinions on Whether or Not Alberta Can Become a Leader in Food R and D, 1984 (by Plant Size)

Employees/Plant	Yes(%)	No(%)	n
WHOLE INDUSTRY	68	32	34
A(1-15 employees)	75	25	20
B,C(16-50)	40	60	5
D,E,F	67	33	9

Two-thirds of the respondents felt that Alberta does have the potential to become a leader in developing new products and processes.

75% of the smaller firms felt that Alberta could become a leader in food research. Two thirds of the large plant

respondents agreed with this. Some of the respondents, in their explanations, cited that government involvement and support was needed to bring this about.

Question B.7. If you answered "No" to question B.6, where do you feel these new products and processes will originate, and why?

Most "no" respondents felt that the U.S., Japan, and Europe, in that order, would be the likely creators of new products and processes. Other respondents cited Eastern Canada as a more likely source of origin than Western Canada.

Summary of Phase III

Phase III of the study looked at the **Research and Development Needs of Alberta Food Processors.** The bulk of the discussion was derived from the results of Questionnaire II, with a further refining of responses provided by Questionnaire III. The results from Questionnaire II were mixed. Part A provided satisfactory responses to the questions about present concerns, however, Part B did not meet expectations. Questions dealing with the future were, in many cases, passed over likely because of the economic uncertainty facing many food processors today.

R and D Attitudes

The respondents were asked if they considered their food processing sector to be technologically innovative.

Results received indicated that 65% considered their sectors to be "moderately innovative". A few (5%) respondents in the meat and miscellaneous groups felt that their sector was "very innovative". The size analysis indicated that the larger firms were more apt to view themselves as technically innovative. The smaller firms tend to perceive themselves as "moderately" to "not innovative". There was some confusion in the responses because many of the firms did not appear to have a clear idea of how they fared in terms of technology or innovativeness.

R and D Funds

Survey participants were asked if they normally budget for R and D. Of the entire group of respondents, only 20% indicated that they had budgeted for R and D. Firm size analysis showed us that 56% of this group were large firms. The small firms only made up 7% of this already small group of firms budgeting for R and D.

Funding for R and D was derived from several sources, including the marketing budget, company profits, and operating funds. Those who did not regularly budget for R and D generally derived their funds from company profits.

R and D Future

The majority of respondents (56%) felt that further R and D would be worthwhile. Looking at response by firm

size, 88% of the large firms reported further R and D would be worthwhile while 65% of the small firms held this view.

Areas for further research were given by the respondents as well, with the most common choice being "new product development".

The most frequently cited deterrents to investment in more R and D were "lack of funds coupled with the high cost of borrowing" and problems associated with "small firm size".

Questions dealing with the use of organized research pools yielded some interesting results. Respondents were asked if they considered research pools to be an effective way to conduct R and D. Overall, 62% of respondents considered research pools to be "moderately effective" to "very effective". Those that had actually participated in research pools (only 9) responded more favourably. It appears that the perceived effects of research pooling were more negative than the actual experiences of those who had previously been involved in a research pool.

Government and R and D

There were six questions dealing with government and government participation in R and D. Of the 59% of respondents who felt that government could take further actions to stimulate technological change, the most commonly listed areas were "Low interest loans / cost

sharing / direct funding". The list of R and D identified by the respondents with which the government should be involved with placed "new product development" the highest.

With respect to adequacy of government programs to meet firm needs, 60% of the respondents felt that current programs were "moderately" to "very effective". The remaining 40% felt that government programs were "not effective". However, when looking at the responses of the different sized firms, the largest firms tended to be the most favourable, replying 88% of the time in the "very" to "moderately effective" range (versus 44% for small firms).

When asking the respondents how they became aware of the programs, brochures, trade shows, newspapers, liason officers, and word of mouth were all common replies. Respondents were asked if they felt that government efforts to inform them were effective and 66% of the large firms replied "moderately" to "very effective". However, only 33% of the small firms responded affirmatively to this question.

The Future

Respondents were asked what types of incentives their company would need to encourage them to conduct more R and D. The highest ranking type of incentive listed was "availability of grants from government".

With regard to new products and processes in the future, the response was rather inadequate but several new ideas for products and processes were listed. The motives to introduce such new methods were generally "cost reduction", "increased consumer demand" and "increased quality".

Finally, processors were asked if they felt that Alberta had the potential to become a leader in developing new products and processes. 75% and 67% of the small and large firms, respectively, felt that this was possible. Those who felt that Alberta did not have the required potential indicated that the U.S., Japan and Europe were more likely candidates to be creators of new products and processes. A few also cited Eastern Canada as a potential home to the new ideas.

VII. CONCLUSIONS AND RECOMMENDATIONS

Study Overview

This study was designed to meet several objectives.[117] An attempt has been made to provide some insight into the Industrial Organization of the food processing industry in Canada. Limited reference was made to Alberta because very little information has been published in this area. Similarly, many of the references utilized were dated, making it necessary to recommend further study in several areas, including Industrial Organization.

A literature review of recent studies on technological innovation has been undertaken. Reference was made to work carried out in Canada, the U.S., and the U.K.

The work undertaken has also provided a discussion of major government programs that are applicable to Canadian food processors who wish to develop new products or processes. As well, a review of a recent Task Force report on Federal Policies and Programs for Technology Development was undertaken which discussed and criticized current programs.

The main objectives of the study, however, were met by questionning industry spokesmen and analyzing their opinions on adoption of technology.

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[117]Study Objectives are outlined in Chapter I of this thesis.

Fulfilment of Objectives

Due to a low participation rate among the large firms, the structural objectives could not be fully met. The more important objectives, in terms of this study, which dealt with the relevance of and incentives for more research and development, yielded more accurate results.

The first objective was to examine the organizational structure of the food processing industry in Alberta, and Canada in general. This was accomplished to some degree through a review of Organization Theory literature. Further supportive data was intended to be collected through primary research (Questionnaire I) which examined location and size of plants and markets. Without strong participation from the large firms operating in Alberta, no new structural conclusions could be supported. Little evidence was gathered to indicate market concentration levels or any other indicators along those lines. Such information is usually difficult to collect. Detailed structural information is usually gathered through a case study approach of individual firms, which is beyond the scope of this thesis.

The second objective was to classify food processing plants by years of operation, size, and current level of technological commitment. In meeting this objective, an inventory of the remaining economic life of equipment and buildings was compiled. As well, information was gathered to indicate the level of spendings on R and D by sector and size-based breakdowns. The results were generally as

expected. The problem of low participation among large firms again tended to yield a somewhat non-representative sample of firms. With such samples, only broad conclusions can be made. For example, we have evidence to show that large firms tend to devote more resources to research and development, although no reliable quantitative evaluations can be made (i.e. How much more do large firms spend on R and D than small firms?).

The remaining four study objectives dealt exclusively with technological progressiveness. The most important observations, in terms of future actions and incentives, were made from examining the results of Questionnaires II and III. Opinions and concerns of food processors were ranked and distilled to yield indicators of industry requirements. Again, because of low large-firm response, the opinions expressed may be biased to reflect more strongly the views of small and medium-sized processors. This may threaten the relevance of the conclusions made because the markets often tend to be dominated by a few large firms. However, the results discussed may represent the views of the majority of food processors in Alberta. The question of relevance is political as well as economic; whether one manager's opinions should be weighted by the output of his plant relative to others is debatable.

Although each chapter has already been summarized, some concluding comments will help tie the major observations of

the primary research together.

First, the majority of firms did not budget for research and development, but most firms felt that further R and D would be worthwhile. The majority of respondents also felt that technological change was critical to improving Alberta's position in food processing.

Second, the two greatest deterrents to further R and D were reported to be lack of funds and small firm size. A possible non-government solution may be the use of research pools which have received positive support from managers with previous experience in such ventures.

Third, most processors responding felt that government could take steps to assist in R and D. Low interest loans, cost sharing and direct funding were the most highly ranked incentives to support private investment. Direct government action was also encouraged in new product and process development, and in large and costly research projects.

Fourth, the large firms responding, those presumed to be able to meet government eligibility criteria, considered government efforts to be more effective than did the small firms.

Fifth, technological research is critical to Alberta's food processing industry, but other areas have been identified as possibly more important. Market development, transportation costs, and employee training were the most frequently cited areas which affect the sector's competitive position more than technological change.

Finally, despite the fact that very few firms in this study budgeted for R and D, two thirds of them were optimistic about Alberta's potential to become a leader in developing new products and processes.

Based on the results of this study, it is evident that Alberta's food processors do consider research and development to be important to their future. What is unclear, however, is the role that food processors wish government to take. Does the industry prefer government financing to direct government-run research or does it prefer no government involvement at all? One must keep in mind that one-third of the respondents felt that further government involvement was not necessary. As well, the question arises as to whether further support should be provided to "small" and "medium-sized"[118] firms, with very small market shares, or to focus on the large, "more efficient" processing plants.

Recommendations

This research has been undertaken as a first step in studying Canada's food processing industry. Several conclusions have been made and some recommendations are listed below.

1. If it is the intention of the governments to make assistance available to all economically viable firms,

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[118] "Small" and "Medium-sized" as defined in this study.

regardless of size or years of operation, then application procedures for research and development incentive programs may have to be redesigned. Eligibility criteria and administrative lag time are two key areas which deserve immediate attention.

2. Expanded use of research pools should be encouraged, where feasible, as a possible alternative to government assistance.
3. Availability of program information has been identified as a problem. The use of "Science Extension Officers" or other forms of communication which improve the awareness of processors regarding assistance programs would be beneficial.
4. This study has just begun to describe the attitudes of industry towards government. Further work is needed to ascertain the exact role that private industry wishes government to have in R and D. Such information can only be collected through direct interface between government and the food processing industry.
5. As an addendum to this study, it is recommended that workshops be organized in central locations in Alberta that would facilitate open communication between government representatives (Federal and Provincial) and the industry. The importance of personal contact with food processors should be stressed when arranging such meetings to ensure fair respresentation from all sectors and plant/firm-size groups.

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APPENDIX I

A brief note on the Development Index

Districts are defined by the Act[1] to be census divisions established from time to time by Statistics Canada for purposes of tabulating and publishing census data. These districts are arranged into tier groups via a Development Index which uses the following formula:

$$Q = 50E + 40Y + 10R$$

where: Q is the ranking indicator
E is the employment measurement
Y is the income measurement
R is the revenue measurement

Calculations of Q, E, Y, and R are given in The Act. Much of the information used to calculate the values are derived from Statistics Canada aggregate data and the Department of National Revenue.

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[1] Government of Canada, Department of Regional Industrial Expansion, *Industrial and Regional Development Act and Regulations*, November, 1983, p. 13.

APPENDICES II, III and IV

Appendices II, III and IV refer to the three questionnaires used in this thesis. They have not been attached because all of the questions contained in the questionnaires have been highlighted in **bold** font throughout this report. However, if you wish to obtain copies of these questionnaires, please contact:

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